

SECTION 07 13 52
MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies modified bituminous sheet material used for exterior below grade waterproofing and split slab waterproofing.

1.2 MANUFACTURER'S QUALIFICATIONS

- A. Approval by Contracting Officer is required of products and services of proposed manufacturers, and installers, and will be based upon submission by Contractor that:
 - 1. Manufacturer regularly and presently manufactures bituminous sheet waterproofing as one of its principal products.
 - 2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items.
 - 3. Manufacturer's product submitted has been in satisfactory and efficient operation on three similar installations for at least three years.
 - 4. Submit list of installations, include name and location of project and name of owner.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Bituminous sheet.
 - 2. Primer.
 - 3. Mastic.
 - 4. Protection material, temporary and permanent.
 - 5. Printed installation instructions for conditions specified.
- C. Certificates:
 - 1. Indicating bituminous sheet manufacturer's approval of primer, and roof cement.
 - 2. Indicating bituminous sheet waterproofing manufacturer's qualifications as specified.
 - 3. Approval of installer by bituminous sheet manufacturers.
 - 4. Water test report.
- D. LEED Information:
 - 1. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of

origin for products procured within a 500 mile radius of the project.

a. Include statement indicating costs for each product submitted.

2. TBD

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job in manufacturer's original unopened container.

B. Do not store material in areas where temperature is lower than 10 degrees C (50 degrees F,) or where prolonged temperature is above 32 degrees C (90 degrees F).

1.5 ENVIRONMENTAL REQUIREMENTS

A. Ambient Surface and Material Temperature: Not less than 4 degrees C (40 degrees F), during application of waterproofing.

1.6 WARRANTY

A. Warrant bituminous sheet waterproofing installation against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period is two years.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by basic designation only.

B. Federal Specifications (Fed. Spec.):

UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, Water-
INT AMD 1 Proof, Water Repellent and Fire Resistant)

C. American Society for Testing and Materials (ASTM):

C578-07.....Rigid Cellular Polystyrene Thermal Insulation

D41-05.....Asphalt Primer Used in Roofing, Dampproofing
and Waterproofing

D2822-05.....Asphalt Roof Cement

D6380-03.....Asphalt Roll Roofing (Organic Felt)

D. American Hardboard Association (AHA):

A135.4-1995.....Basic Hardboard

PART 2 - PRODUCTS

2.1 BITUMINOUS SHEET

A. Cold applied waterproofing membrane composed primarily of modified bituminous material prefabricated in sheet form designed for below grade exterior and split slab waterproofing. Sheet reinforced with fibers at manufacturer's option.

- B. Thickness of Bituminous Sheet: 1.5 mm (60 mils), plus or minus 0.13 mm (5 mils), and bonded to a 0.1 mm (4 mil) thick plastic sheet.
- C. Provide with a release sheet to prevent bonding of bituminous sheet to itself.

2.2 PRIMER AND ROOF CEMENT

- A. Furnished by manufacturer of bituminous sheet as required for particular application in accordance with sheet manufacturer's instructions.
- B. Primer: ASTM D41.
- C. Roof Cement: ASTM D4586.

2.3 PROTECTION MATERIAL

- A. Drainage Mat: Multi-composite prefabricated drainage material consisting of polystyrene core (ASTM c578) covered with one side of filter fabric; polypropylene.
- B. Hardboard: PS-58, Service Type, 6 mm (1/4-inch) thick.
- C. Roll Roofing: ASTM D6380, Class S (smooth), Type III with minimum net mass per unit area of roofing, 2495 g/m² (51 lb/100 ft²).

2.4 PATCHING COMPOUND

- A. factory prepared, non-shrinking, fast setting, cementitious adhesive compound containing no ferrous metal or oxide.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Condition:
 - 1. Before applying waterproofing materials, ensure concrete and masonry surfaces are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion.
 - 2. Fill voids, joints, and cracks with patching compound.
- B. Concrete surfaces cured a minimum of seven days, free from release agents, concrete curing agents, and other contaminates.

3.2 APPLICATION

- A. Priming:
 - 1. Prime concrete and masonry surfaces.
 - 2. Application method, amount of primer and condition or primer before installation of bituminous sheet as recommended by primer manufacturer.
 - 3. Reprime when required in accordance with manufacturer's instructions.

B. Bituminous Sheet Installation:

1. Remove release sheet prior to application.
2. Lay bituminous sheet from low point to high point so that laps shed water.
3. Treat expansion, construction and control joints and evident working cracks as expansion joints. Apply bituminous sheet in double thickness over joint by first applying a strip of bituminous sheet not less than 200 mm (8 inches) wide, centered over joint.
4. Lap seams not less than 50 mm (2 inches).
5. Lay succeeding sheet with laps, and roll or press into place.
6. Repair misaligned or inadequately lapped seams in accordance with manufacturer's instructions.
7. Seal seams and terminations in accordance with sheet manufacturer's instructions.

C. Corner Treatment:

1. At inside and outside corners apply double cover using an initial strip not less than 280 mm (11 inches) wide, centered along axis of corner.
2. Cover each strip completely by the regular application of bituminous sheet.
3. Provide a fillet or cant on inside corners.
4. Form cants using patching compound
5. Do not use wood, fiber, and insulating materials for cants.

D. Projection Treatment:

1. Apply a double layer of bituminous sheet around pipes and similar projections at least 150 mm (6 inches) wide.
2. At drains, apply a bead of roof cement over a double layer of bituminous sheet under clamping rings.

3.3 PROTECTION

- A. Protect bituminous sheet before backfill or wearing courses are placed.
- B. Install protection material and hold in place in accordance with instructions of manufacturer of waterproofing materials.
- C. Permanent Protection:
 1. Vertical Surfaces:
 - a. Install hardboard and drainage mat.
 - b. Extend protection full height from footing to top of backfill.
 - c. If graded backfill is used, use hardboard and drainage mat.

- D. Temporary Protection: When waterproofing materials are subjected to damage by sunlight and can not be immediately protected as specified, protect waterproofing materials by suitable coating approved by manufacturer of waterproofing system used.

3.4 PATCHING

- A. Repair tears, punctures, air blisters, and inadequately lapped seams, in accordance with manufacturer's instructions before protection course is applied.

3.5 TESTING

- A. Before any protection or wearing course is applied, test all horizontal applications of waterproofing with a minimum of 25 mm (1-inch) head of water above highest point and leave for 24 hours.
- B. Mark leaks and repair when waterproofing is dry.
- C. Certify, to Resident Engineer, that water tests have been made and that areas tested were found watertight.

3.6 INSPECTION

- A. Do not cover waterproofed surfaces by other materials or backfill until work is approved by Resident Engineer.

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SECTION 07 19 20
MOISTURE VAPOR CONTROL SYSTEM**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This Section includes moisture vapor control system for use below interior floor coverings.

1.2 RELATED WORK

- A. Division 09 Sections for patching and leveling compounds applied with floor coverings.

1.3 PERFORMANCE REQUIREMENTS

- A. Apply to ground floor slabs and elevated floor slabs where floor covering material is specified in Division 09 Sections to reduce water vapor emissions of concrete floor slabs to predetermined levels.
- B. Contractor shall assure the surface to meet planarity requirements of a deviation not to exceed 3mm (1/8 inch) under a 3.05 m (10 foot) straight edge.
1. Examine substrates, prior to preparation, the substrate shall be inspected to insure conformance to this Section.
 2. Surface shall be free of foreign material, dirt, grease, paint or other bond breakers.
 3. Verify acceptance of inspected surface prior to performing preparation.
- C. Performance Requirements:

PROPERTY	TEST	RESULT
Permeability	ASTM D1653	0.044 perms
Permeability	ASTM E96 (Water Method)	0.11 perms
Affect of pH	Immersion in Concentrated KoH with pH of 14	No effect
VOC Content	SCAQMO 1168	0g/L

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Plans indicating substrates, locations, and average depths of moisture vapor control system based on survey of substrate conditions.
- C. Manufacturer Certificates: Signed by manufacturers of both moisture vapor control system and floor covering system certifying that products are compatible.
- D. Qualification Data: For Installer.

E. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of moisture vapor control system products required for this Project.
- B. Product Compatibility: Manufacturers of both moisture vapor control system and floor covering system certify in writing that products are compatible.
- C. Preinstallation Conference: Conduct conference at Project site.
- D. Installation of ARDEX Moisture Control System must be by a factory-trained ARDEX LevelMaster Elite Installer who has specific experience with the installation of ARDEX MC.
- E. Applicator must file a pre-installation checklist with the manufacturer and receive written confirmation of the approval to proceed in order to obtain the 10 year ARDEX Moisture Control Warranty.
- F. ARDEX Moisture Control System shall be installed only over concrete surfaces that have been properly mechanically prepared to a minimum surface profile of ICRI CSP #3 and which have a moisture emission level of 20 lbs. or less at the time of testing when measured in accordance with ASTM F1869, or an RH value of 95% or less when measured in accordance with ASTM F2170.
- G. ARDEX Moisture Control System shall reduce the vapor emissions of the concrete to less than 3 lb. and the underlayment or topping surface shall be suitable to receive all types of floor coverings or sealers when allowed to properly dry in accordance with Ardex recommendations.
- H. The device used to measure the RH of the concrete shall be the Wagner Rapid RH Probe.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature and humidity, ventilation, and other conditions affecting moisture vapor control system performance.

1. Place moisture vapor control system only when ambient temperature and temperature of substrates are between 10 and 23 deg C (50 and 70 deg F).

1.8 COORDINATION

- A. Coordinate application of moisture vapor control system with requirements of floor covering products, including adhesives, specified in Division 09 Sections, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 MOISTURE VAPOR CONTROL SYSTEM

- A. Basis-Of-Design Product: Subject to compliance with requirements, provide Ardex; MC Moisture Control System or comparable product.
- B. Epoxy-based moisture control: ARDEX Moisture Control.
- C. Portland cement-based underlayment or topping: Ardex product suitable for the intended use.
- D. Pre-smoothing very uneven substrates: ARDEX S 31 Smoothing Compound.
- E. Fill dormant cracks: Epoxy material MM80 or approved equal.
- F. Sand broadcast into the fresh ARDEX S-MC coat: Fine sand that is less than 1/50 of an inch in grain size or 98.5% passing sieve size #35.
- G. Aggregate: Well graded, washed gravel, 1/8" to 14" or larger.
- H. The device used to measure the RH of the concrete shall be the Wagner Rapid RH Probe.
- I. Water: Potable and at a temperature of not more than 21 deg C (70 deg F).

2.2 MIX DESIGNS

- A. Each individual unit of ARDEX P-MC Primer and ARDEX S-MC Sealer contains separate, pre-measured quantities of the hardener (Part A) and the resin (Part B). The hardening agent (Part A) is added to the resin (Part B).
- B. ARDEX S 21 is mixed in 2-bag batches at one time. Mix each bag of ARDEX S 21 (50 lb.) with 5 quarts of water. Product shall be mixed in an ARDEX T-10 Mixing Drum using an ARDEX T-1 Mixing Paddle and a 1/3" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX S 21 bag label.
- C. For mix designs related to the use of ARDEX underlayments and toppings, refer to the standard mixing instructions for installation over concrete as shown in the manufacturer's installation instructions.

- D. For instructions on the filling of dormant cracks and joints, follow the written instructions of the selected epoxy manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance.
1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through moisture vapor control system.
 2. Fill substrate voids to prevent moisture vapor control system from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair moisture vapor control system bond.
1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 20 lbs. of water (9.06 kg of water) or less in 24 hours.
 2. Moisture Vapor testing in accordance with ASTM F2170 shall be deemed to be at a measured relative humidity of 95% or less as measured by a relative humidity test, such as Wagner RH, at the time of installation of the ARDEX Moisture Control System.
- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with moisture vapor control system according to manufacturer's written instructions.

3.3 APPLICATION

- A. General: Mix and apply moisture vapor control system components according to manufacturer's written instructions.
1. Close areas to traffic during moisture vapor control system application and for time period after application recommended in writing by manufacturer.

2. Coordinate application of components to provide optimum moisture vapor control system -to-substrate and intercoat adhesion.
 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through moisture vapor control system.
- B. Apply moisture vapor control system to produce uniform, level surface.
1. Apply a final layer without aggregate to produce surface.
 2. Feather edges to match adjacent floor elevations.
- C. Cure moisture vapor control system according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- D. Do not install floor coverings over moisture vapor control system until after time period recommended in writing by moisture vapor control system manufacturer.
- E. Remove and replace moisture vapor control system areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 FIELD QUALITY CONTROL

- A. Field sampling of the Ardex products is to be done by taking an entire unopened unit or bag of the product being installed to a Contractor engaged independent testing facility to perform the specified testing. No in situ test procedures for the evaluation of the materials specified shall be performed.

3.5 PROTECTION

- A. Protect moisture vapor control system from concentrated and rolling loads for remainder of construction period.

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SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 RELATED WORK

- A. Insulation for insulated wall panels: Section 07 40 00, ROOFING AND SIDING PANELS.
- B. Insulation in connection with roofing and waterproofing: Section 07 22 00, ROOF AND DECK INSULATION.
- C. Safing insulation: Section 07 84 00, FIRESTOPPING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Insulation, each type used
 - 2. Adhesive, each type used.
 - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.
- D. LEED Information:
 - 1. LEED Credit MR 4.1 and MR 4.2, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.
 - a. Include statement indicating costs for each product submitted.

1.4 STORAGE AND HANDLING

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
- C270-08.....Mortar for Unit Masonry
 - C516-08.....Vermiculite Loose Fill Thermal Insulation
 - C549-06.....Perlite Loose Fill Insulation
 - C552-07.....Cellular Glass Thermal Insulation.
 - C553-08.....Mineral Fiber Blanket Thermal Insulation for
Commercial and Industrial Applications
 - C578-08.....Rigid, Cellular Polystyrene Thermal Insulation
 - C591-08.....Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation
 - C612-04.....Mineral Fiber Block and Board Thermal
Insulation
 - C665-06.....Mineral Fiber Blanket Thermal Insulation for
Light Frame Construction and Manufactured
Housing
 - C728-05.....Perlite Thermal Insulation Board
 - C954-07.....Steel Drill Screws for the Application of
Gypsum Panel Products or Metal Plaster Base to
Steel Studs From 0.033 (0.84 mm) inch to 0.112
inch (2.84 mm) in thickness
 - C1002-07.....Steel Self-Piercing Tapping Screws for the
Application of Gypsum Panel Products or Metal
Plaster Bases to Wood Studs or Steel Studs
 - D312-00(R2006).....Asphalt Used in Roofing
 - E84-08.....Surface Burning Characteristics of Building
Materials
 - F1667-05.....Driven Fasteners: Nails, Spikes and Staples.

PART 2 - PRODUCTS**2.1 INSULATION - GENERAL**

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.

- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Phenolic rigid foam	5 percent recovered material
Rock wool material	75 percent recovered material

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

2.2 MASONRY CAVITY WALL INSULATION

- A. Mineral Fiber Board: ASTM C612, Type II, faced with a vapor retarder having a perm rating of not more than 0.5.
- B. Polystyrene Board: ASTM C578, Type X.

2.3 PERIMETER INSULATION IN CONTACT WITH SOIL

- A. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.

2.4 EXTERIOR FRAMING OR FURRING INSULATION

- A. Batt or Blanket: Optional.
- B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.
- C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

2.5 ACOUSTICAL INSULATION

- A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).
- B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.

C. Thickness as shown; of widths and lengths to fit tight against framing.

2.6 SOUND DEADENING BOARD

A. Mineral Fiber Board: ASTM C612, Type IB, 13 mm (1/2 inch thick).

B. Perlite Board: ASTM C728, 13 mm (1/2 inch thick).

2.7 RIGID INSULATION

A. On the inside face of exterior walls, spandrel beams, floors, bottom of slabs, and where shown.

B. Mineral Fiber Board: ASTM C612, Type IB or 2.

C. Perlite Board: ASTM C728.

D. Cellular Glass Block: ASTM C552, Type I.

2.8 FASTENERS

A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.

B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.

C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

2.9 ADHESIVE

A. As recommended by the manufacturer of the insulation.

B. Asphalt: ASTM D312, Type III or IV.

C. Mortar: ASTM C270, Type 0.

2.10 TAPE

A. Pressure sensitive adhesive on one face.

B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.

B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.

C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.

D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 MASONRY CAVITY WALLS

- A. Mount insulation on exterior faces of inner wythes of masonry cavity walls and brick faced concrete walls. Fill joints with same material used for bonding.
- B. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
- C. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.

3.3 PERIMETER INSULATION

- A. Vertical insulation:
 - 1. Fill joints of insulation with same material used for bonding.
 - 2. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
- B. Horizontal insulation under concrete floor slab:
 - 1. Lay insulation boards and blocks horizontally on level, compacted and drained fill.
 - 2. Extend insulation from foundation walls towards center of building not less than 600 mm (24 inches) or as shown.

3.4 EXTERIOR FRAMING OR FURRING BLANKET INSULATION

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
- C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- D. Ceiling Insulation and Soffit Insulation:
 - 1. At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
 - 2. In areas where suspended ceilings adjoin areas without suspended ceilings, install either blanket, batt, or mineral fiberboard extending from the suspended ceiling to underside of deck or slab above. Secure in place to prevent collapse or separation of hung

blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

3.5 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS, FLOORS, AND UNDERSIDE OF FLOORS

- A. On the interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to the face of studs for interior wall finish where shown.
- B. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.
- C. Use impaling pins for attachment to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.
- D. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings not more than 300 mm (12 inches) apart. Stagger fasteners at joints of boards. Install at each corner.

3.6 ACOUSTICAL INSULATION

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.
- F. Where sound deadening board is shown, secure with adhesive to masonry or concrete walls and with screws to metal or wood framing. Secure sufficiently in place until subsequent cover is installed. Seal all cracks with caulking.

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SECTION 07 21 19.01
INSULATED COMPOSITE BACKUP PANEL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide steel faced foamed-in-plane insulated composite wall panels with interlocking side joints, integral factory applied air and vapor seals, and concealed side joint structural fastening as backup for brick veneer cavity wall on cold-formed metal studwall framing.
- B. Insulated composite backup panel assemblies shall provide complete air and vapor barrier system in addition to specified thermal insulation for exterior walls.

1.2 RELATED WORK

- A. Cold-formed metal studwall framing: Section 05 40 00, COLD-FORMED METAL FRAMING.
- B. Brick Veneer: Section 04 20 00, UNIT MASONRY.
- C. Blast Resistant Loading and Design Requirements: Section 08 56 53 BLAST RESISTANT WINDOWS.

1.3 QUALITY CONTROL

- A. Manufacturer shall have minimum of 5 years experience in the production of insulated composite backup panel systems for the intended use.
- B. Installer shall be approved by manufacturer.
- C. Panel Performance: The following tests shall have been performed by an independent testing agency.
 - 1. Structural Design: Supports minimum 20 PSI uniform load without backside fastening as tested in accordance with ASTM E72, chamber method. Meets performance requirements of Section 08 56 53 BLAST RESISTANT WINDOWS.
 - 2. Thermal Transmission: Minimum R21 as tested in accordance with ASTM C1363 and ASTM C518 and corrected for 15 mph wind outside and still air inside.
 - 3. Air Infiltration: Maximum 0.03 CFM per square foot as tested in accordance with ASTM E283 at static air pressure of 1.56 PSF.
 - 4. Water Penetration: No uncontrolled water penetration as tested in accordance with ASTM E331 at static air pressure of 10 PSF.

5. Surface Burning Characteristics: Flame spread index of less than 25 and smoke developed index of less than 450 as tested in accordance with ASTM E84.
6. In addition, wall panel units shall be classified as a component of fire resistant non-load bearing construction in accordance with UL 263, and shall be approved as Class 1 insulated wall panel in accordance with FM standard 4880.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data.
- C. Shop Drawings: Typical wall section.
- D. Laboratory Test Reports: Panel performance tests.

1.5 DELIVERY, STORAGE AND MARKING

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.
- B. Keep materials dry, and store in dry, weathertight facilities.
- C. Protect from damage during handling and before, during and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
 1. A653-05 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron-Alloy-Coated (Galvannealed) by Hot-Dip Process
 2. A792-05 Steel Sheet, 55% Aluminum-Zinc-Alloy-Coated by Hot-Dip Process
 3. C518-04 Steady-State Thermal Transmission Properties by Means of the Heat-Flow Meter Apparatus
 4. C1363-05 Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

5. E72-05 Conducting Strength Tests of Panels for Building Construction
6. E84-05 Surface Burning Characteristics of Building Materials
7. E283-04 Determining Rate of Air Leakage Through Exterior Windows, Curtain Wall, and Doors Under Specified Pressure Differences Across the Specimen
8. E331-00 Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference

C. Factory Mutual Global (FM):

1. FM 4880 Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems

D. Underwriters Laboratories (UL):

1. UL 263 Fire Tests of Building Construction and Materials

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Exterior and Interior Faces: Galvanized steel, minimum 28 gauge, complying with ASTM A653, grade 37 or ASTM A792, Grade 37, smooth texture with plank stiffeners on liner face, and with 0.2 mil epoxy primer coating on exterior face.
- B. Insulation Core: Polyisocyanurate foam poured-in-place between faces to fill and voids in panel and providing the following minimum properties:
 1. Density: 2.4 PCF
 2. Shear Stress: 15 PSI
 3. Compressive Strength: 15 PSI
 4. Tensile Strength: 20 PSI
- C. Fastenings: Manufacturer's recommended types and including weather resistant barrier applied to metal facer at point of fastener penetration.
 1. Fasteners for brick ties shall be type and size to penetrate backup panel and securely connect to cold-formed metal studwall system.

D. Accessories: Manufacturer's recommended materials, including the following, sized for purpose indicated:

1. Metal cover plate of galvanized steel with epoxy primer coating on one face.
2. Aluminum tape, minimum 2 inches wide, with pressure sensitive adhesive for bonding to metal surfaces.

2.2 FABRICATION

- A. Panels shall be 3 inches thick, 32 inches high modules.
- B. Lengthwise panel edges shall be tongue and groove design with factory applied air, water and vapor seal.
- C. Side edges shall be formed to engage adjacent panel on liner side and to conceal structural fasteners in the joint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Cold-form metal studwall framing shall not exceed the following alignment tolerances:
 1. 3/8 inch in any 20 feet length vertically and horizontally.
 2. 3/4 inch deviation from girt plane.
- B. Defects in support framing shall be corrected prior to installation of backup panels.

3.2 INSTALLATION

- A. Election shall comply with manufacturer's instructions, including standards for cutting, sealing and attachment.
- B. Gaps at panel ends or at cut edges shall be sealed with a metal cover plate.
- C. Joints with window and door frames shall be sealed with aluminum tape to continue air and vapor barrier.

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SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Installation of roof and deck insulation, and vapor retarder and protection board on new construction ready to receive roofing or waterproof membrane.
- B. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

- A. Wood blocking and edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Perimeter, rigid, and batt or blanket insulation: Section 07 21 13, THERMAL INSULATION.
- C. Sheet metal components: Section 07 60 00, FLASHING AND SHEET METAL.

1.3 QUALITY CONTROL

- A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisors qualification.
- B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Asphalt materials, each type
 - 2. Roofing cement, each type
 - 3. Roof insulation, each type
 - 4. Fastening requirements
 - 5. Insulation span data for flutes of metal decks
- C. Samples:
 - 1. Roof insulation, each type
 - 2. Nails and fasteners, each type
- D. Certificates:
 - 1. Indicating type, thickness and thermal conductance of insulation. Minimum thickness at roof drains to meet 2 inches.
 - 2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.

3. Adhesives, each type.

E. Laboratory Test Reports: Thermal values of insulation products.

F. Layout of tapered roof system showing units required.

G. Documentation of supervisors training and experience showing knowledge of roofing procedures.

H. LEED Information:

1. LEED Credit MR 4.1 and MR 4.2, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content.

a. Include statement indicating costs for each product having recycled content.

2. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.

a. Include statement indicating costs for each product submitted.

1.5 DELIVERY, STORAGE AND MARKING

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.

B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.

1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.

2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.

C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft,
Waterproofed, Water Repellent and Fire
Resistant)

C. American Society for Testing and Materials (ASTM):

- C208-08.....Cellulosic Fiber Insulating Board
- C209-07.....Test Methods for Cellulosic Fiber Insulating Board
- C552-07.....Cellular Glass Thermal Insulation
- C726-05.....Mineral Fiber Roof Insulation Board
- C728-05.....Perlite Thermal Insulation Board
- C1289-08.....Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- D41-05.....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
- D312-00(R2006).....Asphalt Used in Roofing
- D2178-04.....Asphalt Glass Felt Used in Roofing and Waterproofing
- D2822-05.....Asphalt Roof Cement
- F1667-05.....Driven Fasteners: Nails, Spikes, and Staples

D. Factory Mutual Global (FM):

- 1-28.....Winds Loads to Roof Systems and Roof Deck Securement
- P7825-05.....Approval Guide

E. National Roofing Contractors Association (NRCA):

The NRCA Roofing Manual 2009

F. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory (2009)

G. U.S. Department of Commerce (NBS):

PS 1-07.....Structural Plywood

H. National Particleboard Association (NPA):

A208.1-93.....Mat-Formed Wood Particleboard

1.7 QUALITY ASSURANCE:

- A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-

classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

- A. Primer: ASTM D41.
- B. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.
- C. Roof Cement: ASTM D2822, Type I or Type II, asbestos free; or, D4586, Type I or Type II.

2.2 INSULATION

- A. Perlite Board: ASTM C728.
- B. Isocyanurate Board: ASTM C1289, Type I, Class 2 or Type III.
- C. Tapered Roof Insulation System Segments:
 - 1. Fabricate of mineral fiberboard, isocyanurate, or perlite board. Use only one insulation material for tapered sections.
 - 2. Cut to provide high and low points with crickets and slopes as shown.
 - 3. Minimum thickness of tapered sections; 13 mm (1/2 inch), unless manufacturers allow taper to zero mm (inch).

2.3 MISCELLANEOUS

- A. Tapered Edge Strips:
 - 1. Tapered 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.

2.4 FASTENERS

- A. Type as designated for item anchored and for substrate.
- B. Fasteners for securing insulation, base and concrete sheets, and vapor retarder to steel decks:
 - 1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.

2.5 RECOVERED MATERIALS

- A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material

Material Type	Percent by Weight
Foam-in-place	5 percent recovered material
Rock wool material	75 percent recovered material

- B. The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.
- B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.
- C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.
- D. Dry out surfaces, including the flutes of metal deck, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.
- E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 °C (50 °F). Do not apply materials to substrate having temperature of 10 °C (50 °F) or less.
- F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

3.2 SURFACE PREPARATION

- A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- B. Remove projections that might damage materials.

C. Concrete Decks:

1. Test concrete decks for moisture prior to application of materials.

D. Existing Roofs:

1. At areas to be altered or repaired, remove loose insulation and wet insulation.
2. Cut and remove existing insulation and vapor retarder for new work to be installed. Clean cut edges and install a temporary seal to cut surfaces. Use roof cement and one layer of 7 kg (15 pound) felt strip cut to extend 150 mm (6 inches) on each side of cut surface. Bed strip in roof cement and cover strip with roof cement to completely embed the felt.

3.3 VAPOR RETARDER

A. General:

1. Install a fully adhered continuous vapor retarder on roof decks as specified and required by manufacturer to achieve 20 year warranty for roof system.
2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.
3. At all pipes, walls, and similar penetrations through vapor retarder, seal openings with roof cement to prevent moisture entry from below.
4. Seal penetrations with roof cement.

B. Cast in Place Concrete Decks:

1. Prime deck as specified.
2. Apply fully adhered continuous vapor retarder as specified and required by manufacturer to achieve a 20 year warranty for the roof system.

C. Steel Deck:

1. Material and method of application of roofing systems used on metal decks shall meet the requirements of Underwriters Laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
2. Mechanically anchor a 16 mm (5/8 inch) thick layer of gypsum sheathing to meet the requirements of Factory Mutual Research Corporation for Class 1-90 Insulated Steel Deck Roofs.
3. Locate the long dimension edge joints to have solid bearing on top of decking ribs; do not cantilever over rib openings or flutes.

4. Apply fully adhered vapor barrier to gypsum sheathing with adhesive as required by manufacturer to achieve a 20 year warranty for roofing system.

3.4 SELECTION OF RIGID INSULATION

A. Insulation Type:

1. Use perlite board, and isocyanurate board.
2. Use not less than two layers of insulation unless specified otherwise.
3. Use 25 mm (one inch) thick perlite board as first layer over steel decks. Do not use phenolic, isocyanurate, or urethane board type insulation directly on steel roof decks.
4. Use either 13 mm (1/2 inch) thick perlite board as a top layer over isocyanurate board. Composite board is acceptable.
5. Where tapered insulation is used, all insulation shall be factory tapered, except perlite board may be field tapered.
6. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of not less than 25 for uniform thickness. Minimum 2 inch thickness at roof drains where tapered insulation is used.
2. The minimum thickness of insulation for metal decks shall not be less than recommended by the insulation manufacturer to span the rib opening (flute size) of the metal deck used.
3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.
4. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than that required to achieve R-25.
5. Use not less than two layers of insulation when insulation is 25 mm (one inch) or more in thickness unless specified otherwise.

3.5 INSTALLATION OF INSULATION

- #### **A.**
- Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of

succeeding layers of roof insulation with those in preceding layer. Bed insulation layers in Type III or IV asphalt firmly pressed into the hot bitumen. Keep bitumen below surface of insulation to receive single ply rubber roofing.

- B. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.
- C. Cover all insulation installed on the same day by either:
 - 1. The roofing membrane as specified.
 - 2. Temporary protection as specified.
- D. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- E. Cut to fit tight against blocking or penetrations.
- F. Over Vapor Retarder, or Concrete Deck: Lay insulation in hot bitumen as specified.
- G. Over Nailable Decks:
 - 1. Over poured gypsum, precast gypsum plank, cement-wood fiber plank, wood plank, or plywood deck, install one ply of base sheet or venting base sheet as specified; or, apply two plies of felt.
 - 2. Lay first ply of felt down dry and mop second ply to first ply at laps. Nail both plies to deck as specified.
 - 3. Lay base sheet down dry with mineral surface down; lap and nail down as specified.
 - 4. Lay insulation in hot bitumen over membrane or base sheet as specified.
- H. Steel Deck:
 - 1. Material and method of application of insulation systems used on metal decks shall meet the requirements of Underwriters laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
 - 2. Anchor first layer of insulation with adhesive to 5/8 inch exterior rated GWB to conform to FM Class 1-90, Insulated Steel Roof Deck.
 - 3. Locate the long dimension edge joints to have solid bearing on top of deck ribs; do not cantilever over deck rib openings or flutes.

3.6 PROTECTION (COVER) BOARD

- A. 1/2 inch exterior rated gypsum protection (cover) board over tapered insulation.

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SECTION 07 27 29
FLUID-APPLIED AIR BARRIER - VAPOR PERMEABLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Materials and installation methods for fluid applied, vapor permeable air barrier membrane system located in non-accessible part of wall.
- B. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through wall assembly.

1.2 DEFINITIONS

- A. Air Barrier Assembly: collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through wall.

1.3 PERFORMANCE REQUIREMENTS

- A. Air barrier: Capable of performing as continuous vapor-permeable air barrier and as liquid-water drainage plane flashed to discharge to exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Compliance with 780 CMR 13, Section 1304.3 Air Leakage.
 - 1. 1304.3.1 Air Barriers:
 - a. Building envelope shall be designed and constructed with continuous air barrier to control air leakage into, or out of conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in conditioned space by more than 50 percent of difference between conditioned space and design ambient conditions. Air barrier shall have following characteristics:
 - 1) It must be continuous, with joints made airtight.
 - 2) It shall have an air permeability not to exceed 0.004 CFM/SQ FT under pressure differential of 1.57 PSF (0.3 inch) water (equal to 0.02L/sq. m at 75 Pa.).

- 3) It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on envelope without damage or displacement, and shall transfer load to structure. It shall not displace adjacent materials under full load.
- 4) It shall be durable or maintainable.
- 5) Air barrier shall be joined in an airtight and flexible manner to air barrier material of adjacent systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
 - a) Foundation and walls.
 - b) Walls and windows or doors.
 - c) Different wall systems.
 - d) Wall and roof.
 - e) Wall and roof over unconditioned space.
 - f) Walls, floor and roof across construction, control and expansion joints.
 - g) Walls, floors and roof to utility, pipe and duct penetrations.
- 6) All penetrations of air barrier and paths of air infiltration/exfiltration shall be made airtight.

1.4 REFERENCES

- A. Following standards and publications are applicable to extent referenced in text. most recent version of these standards is implied unless otherwise stated.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM-C920 Specifications for Elastomeric Joint Sealants.
 2. ASTM-C1193 Guide for Use of Joint Sealants.
 3. ASTM-D412 Standard Test Methods for Rubber Properties in Tension.
 4. ASTM-D570 Test Method for Water Absorption of Plastics.
 5. ASTM-D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 6. ASTM-D1876 Test Method for Peel Resistance of Adhesives.
 7. ASTM-D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting.

8. ASTM-D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
9. ATM-D4258 Practice for Surface Cleaning Concrete for Coating.
10. ASTM-D4263 Test Method for Indicating Moisture in Concrete by Plastic Sheet Method.
11. ASTM-E96 Test Methods for Water Vapor Transmission of Materials.
12. ASTM-E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
13. ASTM-E162 Test Method for Surface Flammability of Materials Using Radiant Heat Source.
14. ASTM-E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.
15. ASTM-E2178 Standard Test Method for Air Permeance of Building Materials.
16. ASTM-E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.5 SUBMITTALS

A. Shop Drawings:

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - a. Include details of interfaces with other materials that form part of air barrier.
 - b. Include details of mockups.

B. Product Data:

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

C. Samples:

1. Fluid applied membrane
2. Transition tape
3. Through Wall Flashing

D. Project Information:

1. Product Certificates:

- a. Air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with barrier; signed by product manufacturer.
2. Qualification Data:
 - a. Applicator.
3. Product Test Reports:
 - a. Based on evaluation of comprehensive tests performed by qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM-E2178.

E. Contract Closeout Information:

1. Warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Air barrier systems shall be manufactured and marketed by firm with minimum of 20 years experience in production and sales of waterproofing. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet requirements specified, and include list of projects of similar design and complexity completed within past five years.
- B. Applicator Qualifications: firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with record of successful in-service performance.
- C. Mockups: Before beginning installation of air barrier, provide air barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
 2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

- D. Pre-Installation Meeting: pre-installation meeting shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation meeting shall include Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to following:
1. Review of submittals.
 2. Review of surface preparation, minimum curing period and installation procedures.
 3. Review of special details and flashings.
 4. Sequence of construction, responsibilities and schedule for subsequent operations.
 5. Review of mock-up requirements.
 6. Review of inspection, testing, protection and repair procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.
- B. Do not double-stack pallets of fluid applied membrane components on job site. Provide cover on top and sides, allowing for adequate ventilation.
- C. Protect fluid-applied membrane components from freezing and extreme heat.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to wet substrate or during snow, rain, fog, or mist.

1.9 WARRANTY

- A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials, that

fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.

1. Failures include, but are not limited to, the following:
 - a. Failure to maintain air permeance rating not to exceed 0.02 L/s/sq. m. when tested per ASTM-E2178, within specified warranty period.
 - b. Failure to maintain vapor permeance rating greater than 10 Perms when tested in accordance with ATM-E96, Method B.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design Product: Subject to compliance with requirements, provide specified manufacturers and product system conforming to the Design and Performance Requirements in this section:

1. Fluid-applied Air barrier System (vapor permeable): Grace Construction Products.

B. Comparable Manufacturer:

1. Henry.
2. ProSoCo.
3. Tremco.
4. Sto.

2.2 FLUID-APPLIED AIR BARRIER (VAPOR PERMEABLE)

A. Description: Fluid-Applied, Vapor-Permeable, Membrane Air Barrier.

B. Basis of Design: Subject to compliance with requirements, provide following:

1. Base Product: Single Component Acrylic Membrane: Perm-A-Barrier VP, as manufactured by Grace Construction Products.

C. Physical and Performance Properties: Provide products with following minimum properties:

1. Membrane Air Permeance: Not to exceed 0.0004 CFM/SQ FT of surface area (at specified thickness) at 1.57 LBF/SQ FT pressure difference (0.002 L/s x sq. m of surface area at 75-Pa) when applied to CMU wall; when tested per ASTM-E2178.
2. Membrane Air Leakage: Not to exceed 0.0008 CFM/SQ FT (0.004 L/s x sq. m) when tested per ASTM-E2357.

3. Membrane Vapor Permeance: Not less than 11.2 Perms (649.6 ng/Pa x s x sq. m); when tested per ASTM-E96.
4. UV Exposure Limit: 180 calendar days.

2.3 AUXILIARY MATERIALS

A. General:

1. Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane.
2. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Liquid Membrane for Details and Terminations:

1. Base Product: Bituthene Liquid Membrane as manufactured by Grace Construction Products.

C. Wall Primer (for Use with Through wall Flashing and Tapes Applied to Substrate):

1. Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.
2. Flash Point: No flash to boiling point.
3. Solvent Type: Water.
4. VOC Content: Not to exceed 10 g/l.
5. Application Temperature: -4 degrees C (25 degrees F) and above.
6. Freezing Point (as packaged): -7 degrees C (21 degrees F).
7. Base Product: Perm-A-Barrier WB Primer manufactured by Grace Construction Products.

D. Flexible Membrane Wall Flashing:

1. 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mils) of cross-laminated, high-density polyethylene film to provide min. 1.0 mm (40 mil)-thick membrane.
2. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with following:
 - a. Water Vapor Transmission: ASTM-E96, Method B: 2.9 ng/m²sPa (0.05 Perms) max.
 - b. Water Absorption: ASTM-D570: max. 0.1% by weight.
 - c. Puncture Resistance: ASTM-E154: 356 N (80 pounds) min.
 - d. Tear Resistance
 - 1) Initiation ASTM-D1004: min. 58 N (13.0 pounds) M.D.
 - 2) Propagation ASTM-D1938: min. 40 N (9.0 pounds) M.D.

- e. Lap Adhesion at -4 degrees C (25 degrees F): ASTM-D1876: 880 N/m (5.0 pounds/inch) of width.
 - f. Low Temperature Flexibility ASTM-D1970: Unaffected to -43 degrees C (-45 degrees F).
 - g. Tensile Strength: ASTM-D412, Die C Modified: min. 5.5 MPa (800 PSI).
 - h. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM-D412, Die C: min. 200%.
3. Base Product: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.
- E. Joint Reinforcing Strip:
- 1. Air barrier manufacturer's approved tape.
- F. Transition Tape:
- 1. 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mils) of cross-laminated, high-density polyethylene film to provide min. 1.0 mm (40 mil) thick membrane.
 - 2. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with following:
 - a. Water Vapor Transmission: ASTM-E96, Method B: 2.9 ng/m²sPa (0.05 perms) max.
 - b. Water Absorption: ASTM-D570: max. 0.1% by weight
 - c. Puncture Resistance: ASTM-E154: 356 N (80 pounds) min.
 - d. Tear Resistance:
 - 1) Initiation ASTM-D1004: min. 58 N (13.0 pounds) M.D.
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 - e. Lap Adhesion at -4 degrees C (25 degrees F): ASTM-D1876: 880 N/m (5.0 pounds/inch) of width.
 - f. Low Temperature Flexibility ASTM-D1970: Unaffected to -43 degrees C (-45 degrees F).
 - g. Tensile Strength: ASTM-D412, Die C Modified: min. 5.5 MPa (800 PSI).
 - h. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM-D412, Die C: min. 200%.
3. Base Product: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.
- G. Substrate Patching Membrane:

1. Manufacturer's standard trowel-grade substrate filler.
2. Base Product: Bituthene Liquid Membrane, manufactured by Grace Construction Products.

H. Sprayed Polyurethane Foam (SPF) Sealant:

1. 1- or 2-component, foamed-in-place, polyurethane foam sealant, 24 to 32 kg/M³ (1.5 to 2.0 LBS/FT³) density.
2. Flame spread index of 25 or less according to ASTM-E162.
3. Primer and non-corrosive substrate cleaner recommended by foam sealant manufacturer.

I. Joint Sealant:

1. ASTM-C920, single-component, neutral-curing silicone.
2. Class 100/50 (low-modulus), Grade NS. Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM-D4263.
 4. Verify that masonry joints are struck flush and completely filled with mortar.
 5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of fluid-applied air barrier system.

- B. Exterior sheathing panels: Ensure that boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat board joints with 50 - 75 mm (2-3 inches) wide, manufacturer's recommended self-adhesive tape. Gaps greater than 6 mm (1/4 inch) should be filled with mastic or caulk, allowing sufficient time to fully cure before application of tape and fluid applied air barrier system.
- C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill voids and holes, particularly in mortar joints, with lean mortar mix, non-shrinking grout or parge coat.
- D. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- E. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- F. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- G. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- H. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
- I. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- J. At changes in substrate plane, apply sealant or Bituthene Liquid Membrane at sharp corners and edges to form smooth transition from one plane to another.
- K. Cover gaps in substrate plane and form smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM-C1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM-D4258 before coating surfaces.

- 1. Prime substrate as required.

- B. Gypsum Sheathing: Fill joints greater than 6 mm (1/4 inch) with sealant according to ASTM-C1193 and with air barrier manufacturer's written instructions. Apply tape to joint prior to installing fluid air barrier membrane.

3.4 AIR BARRIER MEMBRANE INSTALLATION

- A. Apply air barrier membrane to achieve continuous air barrier according to air barrier manufacturer's written instructions.

- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

- C. Apply continuous unbroken air barrier to substrates according to following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

- 1. Vapor-Permeable Membrane Air Barrier: 2.4 mm (90 mil) wet film thickness, 1.2 mm (45 mil) dry film thickness.

- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.5 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form seal with adjacent construction and maintain continuous air barrier.

- 1. Coordinate installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

- 2. Install strip on roofing membrane or base flashing so that minimum of 75 mm (3 inch) of coverage is achieved over both substrates.

- 3. Install flashings only after application of air barrier.

- B. Apply primer to substrates to receive transition tapes at required rate and allow to dry. Limit priming to areas that will be covered by

transition tape in same day. Re-prime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that minimum of 75 mm (3 inch) of coverage is achieved over both substrates. Maintain 75 mm (3 inch) of full contact over firm bearing to perimeter frames with not less than 25 mm (1 inch) of full contact.
1. Transition Strip: Roll firmly to enhance adhesion.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 150 mm (6 inch) beyond repaired areas in strip direction.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include following:

1. Continuity of air barrier system has been achieved throughout building envelope with no gaps or holes.
2. Continuous structural support of air barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests: Testing to be performed will be determined by Owner's testing agency from among following tests:

1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM-E1186, smoke pencil with pressurization or depressurization.

D. Remove and replace deficient air barrier components and retest as specified above.

3.7 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

- B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 150 days.
- C. Clean spills, stains, and soiling from construction that would be exposed in completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Remove masking materials after installation.

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**SECTION 07 40 00
ROOFING AND SIDING PANELS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies insulated metal wall panels and uninsulated composite metal wall and roof panels as shown.

1.2 RELATED WORK

- A. Sealant: Section 07 92 00, JOINT SEALANTS.
B. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. Insulated metal wall and composite metal wall shall be products of a manufacturer regularly engaged in the fabrication and erection of metal panels and composite metal wall of the type and design shown and specified.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Samples: Metal panel, 150 mm (six inch) square, showing finish, each color and texture. Color chips representing manufacturer's full range of available colors.
C. Shop Drawings: Wall and roof panels, showing details of construction and installation. Collateral steel framing U value thickness and kind of material, closures, flashing, fastenings and related components and accessories.
D. Manufacturer's Literature and Data: Wall and roof panels.
E. Fire Test Report: Report of fire test by recognized testing laboratory for fire rating specified, showing details of construction.
F. LEED Qualifications:

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
B. American Society for Testing and Materials (ASTM):
A653/A653M-07..... Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
A463-06..... Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process

A924/A924M-07 Steel Sheet, Metallic Coated by the Hot-Dip Process

A1008/A1008M-07 Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy

B209/209M-07 Aluminum and Aluminum Alloy Sheet and Plate

C442-04(E2004) Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board

C553-02 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-07 Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C612-04 Mineral Fiber Block and Board Thermal Insulation

E119-08 Fire Test of Building Construction and Materials

PART 2 - PRODUCTS

2.1 SHEET STEEL

- A. Minimum 22 gauge thick for insulated wall panels.
- B. Steel, Sheet, Galvanized: ASTM A653/A653M, Structural.
 - 1. Grade 40, galvanized coating conforming to ASTM A924/A924M, Class Z 275 G-90.

2.2 ALUMINUM SHEET

- A. Two sheets of 0.032 inch aluminum with a thermo set, polymeric core, formed via a Reaction Injection Molding process, with no glues or adhesives between dissimilar materials. Total composite thickness is 8 mm.

2.3 FASTENERS

- A. Fasteners of size, type and holding strength as recommended by manufacturer.

2.4 GYPSUM BACKING BOARD

- A. ASTM-D3273, rating 10, Glass mat facer sheets, 5/8 inches thick, Square edge.

2.5 THERMAL INSULATING MATERIALS

- A. Insulated Panels - Foamed Insulation Core: Urethane or isocyanurate, density 2.7 lb/cu. ft. minimum (43.4 kg/cu. m), minimum compressive strength 20 lb/sq. in. (137.9 kPa), and containing no CFC or HCFC compounds.
- B. Mineral Fiber Blankets: ASTM C553, Type I.
- C. Mineral Fiber Board: ASTM C612, Class I.

2.6 FABRICATION

- A. Insulated metal wall panels shall consist of factory-foamed horizontal wall panel system consisting of an exterior metal sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, with factory sealed tongue-and-groove and rainscreen-design pressure-equalized-chamber horizontal joint, and attached to supports using concealed fasteners. Furnish insulated metal wall with horizontal joints as shown on the drawings. Overall thickness of panels is shown on drawings. Connection between panels shall be by factory sealed tongue and groove and rainscreen design pressure-equalized-chamber horizontal joint. Work shall include collateral steel framing metal and bituminous closures, fastenings, flashing, clip, caulking, and related components and accessories. Construct panels as follows:
1. Exterior face of wall sheet:
 - a. 22 gage 8.64 mm (0.034 inch) smooth (flat) surface thick galvanized steel.
 2. Interior liner face of wall sheet:
 - a. 22 gage, embossed planked galvanized steel.
 3. Insulation shall be urethane or isocyanurate having a "R" value of 20.
 4. Accessories and fastenings shall be the same material and finish as the panels. Thickness and installation of accessories and flashing shall be as recommended by panel manufacturer.
- B. Composite uninsulated metal wall and roof panels shall be aluminum face and liner sheets with a thermo set, polymeric core, of approximate overall depth and configuration shown on drawings. Molded planks and post fabricated rout and return perimeters with attached aluminum extrusion joinery. Horizontal joint to be pressure equalized. Vertical joint to have pre-formed returns as shown on the drawings with gasket and aluminum extrusion receptors and seal plates. Furnish wall and roof panels in lengths indicated on the drawings. Furnish roof panels in one continuous length of roof span and provide cut-outs as required for passage of pipes, conduits, vents and the like. Construct panels as follows:
1. Wall and roof panels:
 - a. 0.8 mm (0.032 inch) thick aluminum, smooth finish. Total composite thickness is 8 mm.

2. Accessories and flashing shall be the same material as the panels. Thickness and installation of accessories and flashing shall be as recommended by the panel manufacturer.

2.7 FINISH

- A. For both insulated metal walls and composite uninsulated metal walls, the finishes shall be as follows:
 1. Fluorocarbon 2 coat finish, consisting of a 0.2 prime coat and a polyvinylidene fluoride finish coat of 0.5 mil minimum dry film thickness on one side, and a wash coat of 0.5 mil minimum dry film thickness applied to reverse side.
- B. Finish numbers for aluminum specified herein are in accordance with The Aluminum Association's Designation System. Each aluminum finish number preceded by letters AA identifies it as an Aluminum Association designation.
- C. Aluminum alloy used for color coating shall be as required to produce specified color. Color shall be as specified in Section 09 06 00, SCHEDULE FOR FINISHES. Color for sheet aluminum shall not deviate more than the colors of extrusion samples.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. Panels shall be in full and firm contact with supports and with each other at side and end laps. Where panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they shall, after the necessary repairs have been made with material of the same type and color as the weather coating, be approved before being installed. All cut ends and edges, including those at openings through the sheets shall be sealed completely. Correct defects or errors in the materials in an approved manner. Replace materials which cannot be corrected in an approved manner with nondefective material. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.
- B. Wall and Roof Panels: Apply panels with the configuration in a horizontal position, or as indicated. Provide panels in the longest obtainable lengths, with end laps occurring only at structural members. Seal side and end laps with joint sealing material. Flash and seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Install closure strips, flashings,

and sealing material in an approved manner that will assure complete weather tightness. Flashing will not be required where approved "self-flashing" panels are used.

- C. Flashing: All flashing and related closures and accessories in connection with the preformed metal panels shall be provided as indicated and as necessary to provide a watertight installation. Details of installation, which are not indicated, shall be in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings. Installation shall allow for expansion and contraction of flashing.
- D. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated. Install fasteners in valleys or crowns as recommended by the manufacturer of the sheet being used. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys, or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels. Remove metal shavings and filings from roofs on completion to prevent rusting and discoloration of the panels.

3.2 ISOLATION OF ALUMINUM

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze, or other metal compatible with aluminum by one of the following:
1. Painting the dissimilar metal with a prime coat of Zinc-Molybdate followed by two coats of aluminum paint.
 2. Placing a non-abrasive tape or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of alkali-resistant bituminous paint.
- C. Paint aluminum in contact with wood or other absorptive materials, that may become repeatedly wet, with two coats of bituminous paint, or two coats of aluminum paint. Seal joints with caulking material.

3.3 PROTECTION AND CLEANING

- A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.
- B. After completion of work, all exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

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SECTION 07 54 23
FULLY ADHERED TPO ROOFING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Applicator qualifications: Manufacturer authorized Roofing Contractor.
- B. Design Criteria:
 - 1. SPRI: "Wind Load Design Guide for Low Sloped Flexible Membrane Roofing Systems".
 - 2. Factory Mutual (FM) Research Corporation: "Loss Prevention Data Sheets 1-28, 29 & 49".
- C. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
- D. Material Standards:
 - 1. TPO Membrane: ASTM-D6878.
- E. Comply with Energy Star criteria for roofing membrane albedo.
- F. Environmental Design Criteria:
 - 1. Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines (CPG): Comply with recovered (recycled) content criteria of the CPG for insulation materials.
 - 2. Environmental Protection Agency (EPA) Energy Star Program: Comply with Energy Star criteria for roofing membrane albedo and the following standards:
 - a. E408, Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
 - b. E903, Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.

1.2 DESIGN RESPONSIBILITY & CRITERIA

- A. Determine the fastener type and spacing needed to resist uplift pressures based "Wind Load Design Guide for Low Sloped Flexible Membrane Roofing Systems" published by SPRI.
 - 1. Basic Wind Speed (3-sec gust, measured at 33 feet above ground, in Exposure B):
 - a. 90 MPH.
 - 2. Exposure:
 - a. "B", Urban/Suburban/Wooded.
 - 3. Importance Factor:
 - a. Category IV.
 - 4. Roof Height(s) and Parapet Height(s): As indicated.
 - 5. Static Pressure of Building Interior: < 0.5 inch water.

B. Design the Fully Adhered TPO roofing system to comply with:

1. FM 1-90.

C. Fire resistance rating:

1. UL 790, Class A.

2. Assembly in conformance with fireproofing as specified.

1.3 SUBMITTALS

A. Shop Drawings:

1. Roof layout showing insulation thicknesses and special details.

2. Profiles of flashing assemblies.

3. Installation Drawings and pertinent details.

4. Indicate location of expansion joints, crickets, saddles, curbs, safety tiebacks, vents, drains and other penetrations.

5. Indicate slope amount and direction, locations of crickets, and key vertical elevation points.

B. Samples:

1. 5 inch x 5 inch specimens of sheet goods.

2. Color swatches of sheet metal colors for pre-selection.

3. 3 inch x 5 inch samples of sheet metal color(s) for final approval.

C. Project Information:

1. Meeting minutes from Pre-Construction Conference.

2. Report by manufacturer's representative that roof has been properly installed.

3. Report showing physical properties of materials.

4. Energy Star data.

D. Contract Closeout Information:

1. Warranty.

2. Maintenance Data:

a. Include cleaning instructions.

3. Certificates.

4. Roofing manufacturer's inspection report.

E. LEED Information:

1. LEED Credit SS 7.2, Reduce Heat Islands: Manufacturer's product data for roofing membrane with verification that membrane's Solar Reflectance Index (SRI), is not less than 78.

2. LEED Credits MR 4.1 and MR 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating percentage by weight of post-consumer and post-industrial recycled content.

3. Environmental Certifications: Provide manufacturer's certification of compliance with the following minimums for recovered (recycled) content, according to the EPA's Comprehensive Procurement Guide.

- a. Certification of minimum 9 percent recovered material content in rigid plastic foams.

1.4 WARRANTY

- A. 20-year warranty of weathertightness signed by roofing materials manufacturer.
 1. Warranty to include coverage for peak gusts of wind to:
 - a. 55 MPH at 33 feet above ground.
 2. Warranty to include the entire system: membrane, flashings, adhesives, sealants, counterflashings, insulation, fasteners, fastener plates, fastener strips, hard rubber or metal edging, metal termination bars, sheet metal copings and edge metal, and other material authorized by manufacturer.
- B. 20-year warranty on 70% PVDF (Kynar 500) coatings on edge metal and copings.

1.5 PRE-CONSTRUCTION CONFERENCE

- A. Pre-construction conference, directed by General Contractor, prior to beginning of roofing work to discuss following:
 1. Contract Document requirements.
 2. Roof plan.
 3. Roofing and flashing details.
 4. Drain and scupper elevations.
 5. Roofing manufacturer's specifications and details.
 6. UL requirements.
 7. Insulation manufacturer's recommendations.
 8. Available on site storage.
 9. Roof protection from damage by other trades.
- B. Attendance is recommended for:
 1. General Contractor.
 2. Roofing installer's superintendent.
 3. Roofing manufacturer's representative.
 4. Sheet metal installer performing metal flashing work.
 5. Mechanical installer.
 6. Plumbing installer.
 7. Deck installer.
 8. Other trades whose work may effect roofing system.
- C. Minimum two weeks prior to conference, roofing installer shall forward pertinent information to General Contractor for review.
 1. Installation drawings.
 2. Manufacturer product data.
 3. Samples of proposed materials.

4. Sample warranty.
5. Other information deemed pertinent for sound and secure application.
- D. Conference shall review specifications, details, application requirements and preliminary work.
- E. Objectives of Pre-construction Conference to include:
Review foreseeable methods and procedures related to roofing work.
 1. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.
 2. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
 3. Review roofing system requirements (drawings, specifications and other contract documents).
 4. Review required submittals both completed and yet to be completed.
 5. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
 6. Review required inspection, testing, certifying and material usage accounting procedures.
 7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
 8. Review notification procedures for weather or non-working days.
 9. Record discussion of conference including decisions and agreements (or disagreements) reached.
 - a. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
- F. Furnish copy of record to each party who may be affected by roofing work, whether or not they were in attendance, and to Owner and Architect.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver to site in original, unopened containers labeled with the manufacturer's name, brand and installation instructions.
- B. Store cleaners and adhesive products, liquid materials and un-cured materials at temperatures between 60 and 80 degF.
 1. When stored at lower temperatures, liquid materials must be restored to at least 60 degF prior to use.
- C. Insulation, sheathing, and cover boards:
 1. Store on pallets off the ground.

2. Cover with a breathable membrane.

D. Lightweight materials shall be weighted down to prevent wind damage.

1.7 JOB CONDITIONS

A. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps.

1. All field splices should be shingled to prevent bucking of water.

B. When loading materials onto the roof, the Applicator must comply with the requirements of the Owner to prevent overloading and possible disturbance to the building structure.

C. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

D. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

E. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

PART 2 - PRODUCTS

2.1 SCHEDULE OF ROOF SYSTEM

A. Roof System 1 - Fully Adhered TPO over Concrete Deck:

1. Vapor Retarder.
2. Insulation.
3. Cover Board.
4. TPO Membrane (fully adhered).

B. Roof System 2 - Fully Adhered TPO over Steel Deck:

1. Gypsum Sheathing.
2. Vapor Retarder.
3. Insulation.
4. Cover Board.
5. TPO Membrane (fully adhered).

2.2 GENERAL

A. General:

1. All components products shall be manufactured by, or accepted as "compatible" by roofing manufacturer and shall comply with specified UL and FM requirements, by the specifier.
 - a. Sheathing, vapor retarder, and cover board shall be accepted by roofing membrane manufacturer and covered by the warranty.

- b. Other products including insulation, membrane, fasteners, fastening plates, walkways and edgings shall be manufactured and supplied by the roofing manufacturer and covered by the warranty.

2.3 SHEATHING

A. Gypsum Sheathing:

1. Water-resistant gypsum core with fiberglass facings.
2. Minimum Thickness:
 - a. 5/8 inch.

2.4 VAPOR RETARDER

A. Vapor Retarder:

1. 2-ply of polyethylene, bonded over one layer of scrim reinforcing.
2. Fire retardant type, with compatible fire retardant adhesive.
3. Minimum Properties:

Minimum Physical Properties - Vapor Retarder		
Property	Test Method	Required Value
Puncture Propagation Tear	ASTM-D256	116 N 26 LBS
Permeance	ASTM-E96	0.036 Perm (US)
Drop Dart	ASTM-D1709, Method B	330 g
Tensile Strength	ASTM-D882	100 LBS / 4,504 PSI
Puncture Strength	ASTM-D4833	26 LBS
Surface Burning Characteristics	ASTM-E84	Class I, Class A

5. Seaming Tape:

- a. Self-adhering, asphaltic mastic.
6. Repair Tape, for punctures and other damaged areas.

2.5 ROOF INSULATION

A. General:

1. Furnished by roofing manufacturer.
2. UL listed for assembly indicated.
3. Provide crickets and saddles as required.
4. Insulation shall be installed in multiple layers with joints staggered.
 - a. The first and second layer of insulation shall be mechanically fastened or adhered to the substrate in accordance with the manufacturer's published specifications.

B. Polyisocyanurate (PISO) roof insulation:

1. Rigid, closed cell foam core bonded to heavy-duty glass fiber mat facers.
2. Material complying with:

Minimum Physical Properties - Polyisocyanurate Insulation		
Property	Test Method	Required Value
Material Standards	ASTM-C1289	Type II, Class 1
	HH-I-1972	Class 1
Density (nominal)	ASTM-D1622	2 PCF
Long Term Thermal Resistance (LTTR) per unit thickness	CAN / ULC-S770	6.0 R per inch
Compressive Strength	ASTM-D1622	20 PSI
Dimensional Stability	ASTM-D2126	2% max., 7 days
Permeance	ASTM-E96	<1.0 Perm (US)
Water Absorption	ASTM-C209	< 1.5% volume
Service Temperature	--	-100 to +250 DegF

3. Minimum Insulation Thickness:

a. Areas where "Tapered" insulation is indicated:

- 1) Provide insulation thickness as required to attain indicated minimum average aged R-Value for entire roof area.
- 2) Minimum 2 inch thickness at roof drains unless greater thickness required for slope and other conditions indicated.
- 3) Taper to provide slope of 1/4 inch per feet.

b. Areas with uniform insulation thickness on sloped structures:

- 1) Minimum Thickness: As indicated.

C. Cover Board: Gypsum-based.

1. Water-resistant gypsum core with fiberglass facings.

2. Minimum Thickness:

- a. 1/2 inch.

2.6 ROOFING MEMBRANE

A. TPO Roofing membrane:

1. Material: Thermoplastic Polyolefin (TPO) single-ply roofing membrane.

- a. Fire Retardant.
- b. Polyester fabric reinforced.

2. Color: White.

3. Thickness: 60 mil thick.

4. Minimum Physical Properties:

Minimum Physical Properties - 60mil, Reinforced, TPO Membrane		
Property	Test Method	Required Value
Tolerance on Nominal Thickness (Max)	ASTM-D751	+/- 10%
Thickness over scrim (Min)	ASTM-D4637	15 mil
	Optical	18 mil
Breaking Strength (Min)	ASTM-D751	225 LBS
	Grab Method	340 LBS
Ultimate Elongation - Fabric Failure (Min)	ASTM-D751	25%
Tear Strength (Min)	ASTM-D751	55 LBS
	B Tongue Tear	130 LBS
Linear Dimensional Change (Shrinkage)	ASTM-D1204	+/- 1.0%
Field Seam - Peel Strength (min)	ASTM-D1876	40 LBS/IN
Permeance (max)	ASTM-E96	<0.1 Perm (US)
Puncture Resistance (min)	FTM 101C Method 2031	250 LBS
Solar Reflectance (albedo X 100)	ASTM-E903	80 (White Membrane)
		25 (Gray Membrane)
Brittleness Point	ASTM-D2137	-40 DegF

B. Membrane flashings, fasteners, adhesives, tapes, cements and sealants:
Roofing manufacturer's standard.

2.7 EDGE METAL AND COPING

A. General:

1. Roofing Manufacturer's pre-engineered, prefabricated system for termination of roofing membrane.
2. All fasteners must be concealed from view.
3. Concealed splice plates, with color matching snap-on covers.
4. Anchor cleats:
 - a. Material: G90 galvanized steel.
 - b. Thickness: 20 GA.
5. Snap-on covers:
 - a. Material: G90 galvanized steel.
 - b. Thickness:
 - 1) For dimensions less than 10 inches: 24 GA.
 - 2) For dimensions 10 to 24 inches: 22 GA.

- c. Finish: 70% PVDF Kynar 500.
- d. Color:
 - 1) To be selected from manufacturers standard colors by Architect.
- 6. Wind Rating: Design for same FM design pressure indicated for balance of roof system.
- 7. Coverage of these items to be included in roof system warranty.
- 8. Comply with applicable FM and SPRI standards.
- B. Roof Edge/Fascia:
 - 1. Match profiles indicated.
 - 2. Include accessories such as pre-fabricated inside and outside corners, Spillout, Overflow and Downspout Scuppers, Edging Extensions, Fascia Sumps, and other items indicated.
- C. Coping:
 - 1. Match profiles indicated.
 - 2. Include accessories such as pre-fabricated inside and outside corners (seamed), End Caps, Saddles, Tee's, Crosses, Transition Pieces and Radiused Copings, and other items indicated.

2.8 FASTENERS

- A. Type, spacing and quantity as recommended by manufacturer.
 - 1. Designed to resist uplift forces generated by specified wind speed.
- B. Minimum pullout values per fastener:
 - 1. For use with 22 GA steel decks: 350 LBS each.
 - 2. For use with light weight concrete decks: 800 LBS each.
- C. Fasteners shall be capable of providing a static back-out resistance of at least 10 IN-LBS.

2.9 WALKWAYS

- A. Walkway Rollgoods:
 - 1. Manufacturer's standard walkway rollgood, designed to protect TPO roof membrane.
 - a. Slip-resistant surface.
 - 2. Nominal Thickness: 15 mil.
 - 3. Width: 30 inches.
 - 4. Color: To be selected by Architect from manufacturer's standard colors.
 - 5. Secure by heat welding tape as recommended by membrane manufacturer.

2.10 RUBBER PAVERS

- A. Interlocking roof pavers fabricated from recycled tires and compatible with roofing membrane without need for protective mats.
 - 1. Size: 24 by 24 inches, 2 inches thick.

2. Weight: Minimum 6 PSF.
 3. Surface: Weather-resistant, non-slip multi-direction drainage pattern.
 4. Color: As selected from manufacturer's standard colors by Architect.
- B. Rubber pavers shall be supplied by membrane roofing manufacturer.

2.11 MISCELLANEOUS ITEMS

- A. Roofing accessories:
1. Use manufacturer's standard prefab accessories where available.
 2. Nailing strips: As detailed and required.
 3. Pipe flashings: Provide for each pipe penetration; include clamps, adhesive and sealants.
 4. Expansion joint covers.
 5. Underlayment for pavers: As recommended by roofing manufacturer.
- B. Adhesives, cleaners, and primers: As recommended by roofing manufacturer.
- C. Treated Wood Blocking: Specified in Section 06000.
- D. Other Materials as required by manufacturer for complete system warranty.

PART 3 - EXECUTION**3.1 INSPECTION**

- A. Inspect entire area to be roofed for acceptability.
- B. Correct, or have corrected, unsatisfactory conditions.

3.2 PREPARATION

- A. Remove standing water from area to be covered prior to starting roofing work.
- B. Install required nailers.
- C. Clear the deck of all debris, ice, water and foreign material prior to installation of any roofing materials

3.3 INSTALLATION OF ROOFING - GENERAL

- A. Install materials in accordance with manufacturer's instructions and recommendations.
- B. Fasteners which will be exposed to view from finished spaces below:
1. Project fastener through roof deck maximum 1 inch and cap.
- C. Comply with the manufacturer's instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.
- D. Install materials in accordance with procedures required for FM and UL assemblies.

3.4 INSTALLATION OF NAILERS

- A. Install nailers at perimeter of each roof level, curbs, skylights, expansion joints, and similar penetrations.

3.5 INSTALLATION - SHEATHING OVER METAL DECK

- A. Lay sheathing tightly butted and cut to fit around penetrations.
- B. Apply per UL requirements.
- C. Attach sheathing to deck in accordance with roofing manufacturer's recommendations.

3.6 INSTALLATION - VAPOR RETARDER

- A. Install in accordance with manufacturer's instructions.
- B. Ensure that surface beneath vapor retarder is smooth with no sharp projections.
- C. Do not proceed until deficiencies are corrected.
- D. Install in largest practical widths.
- E. Install continuously at locations indicated.
 - 1. Insure that no discontinuities occur, including at seams, penetrations, and edge terminations.
 - 2. Join sections of vapor retarder and seal penetrations with mastic tape.
 - 3. Lap joints 4 inch and seal with adhesive.
 - 4. Ensure that surfaces to be taped are clean and dry.
- F. Seal around pipes, conduits, curbs, safety tie-backs, and other penetrations with pipe boots in accordance with manufacturer's instructions.
- G. Maintain continuity of vapor retarder over expansion joints.
- H. Repair holes in vapor retarder with self-adhesive tape recommended by manufacturer.
- I. Protect vapor retarder from damage until covered with insulation.

3.7 INSTALLATION - WOOD BLOCKING

- A. Install where indicated or required for proper securement of roofing system.
- B. Securement of wood blocking:
 - 1. Design to resist a minimum of 200 LBS/LF in any direction per SPRI Test Method RE-1.
- C. Install so that top of blocking is substantially flush (+/- 1/4 inch) with top of insulation.

3.8 INSTALLATION - INSULATION

- A. Where required thickness of insulation is greater than 2 inches:
Install insulation in at least 2 layers.

1. Stagger board joints in successive layers laterally, and longitudinally.
 2. Butt joints tightly, and dress top surface of joints as required to preclude ponding at seams.
 - a. Joints shall not exceed 1/4 inch.
 - b. Joints and gaps greater than 1/4 inch shall be filled with the same material.
 3. Cut insulation neatly to fit around roof penetrations and projections.
- B. Secure insulation to the substrate with the required mechanical fasteners (or adhesive) in accordance with the manufacturer's specifications.
1. Cut insulation neatly to fit around roof penetrations and projections.
 2. Install Cover Board continuously over insulation.
 3. Mechanically fasten or adhere insulation to deck to UL and FM requirements.
 - a. Cover Board fasteners shall be attached through the cover board and all layers of insulation.
- C. Fasteners which will be exposed to view from finished spaces below:
1. Project fastener through roof deck maximum 1 inch and cap.

3.9 INSTALLATION - MEMBRANE

- A. General:
1. Unroll and position membrane without stretching.
 2. Secure the membrane with the required fasteners and plates.
 - a. Spacing as dictated by wind design and project conditions.
 3. Install adjoining membrane sheets in the same manner in accordance with the manufacturer's requirements.
 4. Position sheets to accommodate contours of roof deck.
 - a. Shingle splices to avoid bucking water.
 5. Perimeter Securement: Secure membrane along the perimeter of each roof level, roof section, curb, skylight, interior wall, penthouse, and other penetrations as recommended by membrane manufacturer.
 6. Hot or Cold Weather Procedures: Comply with manufacturer's instructions.
 7. Protect membrane from stains/discoloring caused by adhesives.
- B. Adhering TPO Membrane:
1. Position TPO membrane over substrate.
 2. Fold membrane sheet back lengthwise (onto itself) so half the underside of the membrane is exposed.

3. Apply bonding adhesive in accordance with the manufacturer's instructions, to the exposed underside of the membrane and the corresponding substrate area.
 - a. Do not apply bonding adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet.
 - b. Allow the adhesive to dry until it is tacky.
 - c. Roll the coated membrane into the coated substrate while avoiding wrinkles.
 - d. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
 - e. Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.

C. Membrane Splicing: Hot Air Welding Procedures:

1. Position adjoining sheets to allow a minimum overlap of 2 inches.
2. Hot air weld TPO membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.
 - a. At all splice intersections, roll the seam with a roller prior to membrane seam cooling.
 - b. Where 60 mil membrane is specified: All splice intersections shall be overlaid with non-reinforced TPO flashing material (of type recommended by membrane manufacturer).
3. Probe all seams once the hot air welds have thoroughly cooled approximately 30 minutes.
4. Repair all seam deficiencies the same day they are discovered.
5. Apply sealant of type recommended by membrane manufacturer on all cut edges of reinforced membrane where the scrim reinforcement is exposed after seam probing is complete.
6. Pull the membrane back along the welded splice so the entire underside of the membrane is exposed once the Hot Air Weld has been completed.
 - a. Apply bonding adhesive to the exposed underside of the membrane sheet and the substrate.
 - b. Allow adhesive to dry until tacky and roll the membrane into the substrate and brush down the bonded section with a bristle broom following the procedure noted above.
 - c. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously.

D. Flashing:

1. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.
2. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced TPO membrane.
3. Manufacturers standard, non-reinforced TPO membrane can be used for flashing pipe penetrations, sealant pockets, scuppers, as well as inside and outside corners when the use of pre-fabricated accessories is not feasible.
4. Terminate base-of-wall flashings in accordance with manufacturer's approved details.
5. Pre-flashing at sheet metal parapet copings:
 - a. Extend TPO membrane and/or flashing over top of parapet prior to capping with sheet metal.

3.10 INSTALLATION - EDGE METAL AND COPING

- A. Verify that blocking has been installed and adequately secured.
- B. Sub-flash all details with a layer of TPO membrane prior to installation of edge metal or coping system.
- C. Secure anchor cleat to blocking as recommended, using corrosion-resistant fasteners.
- D. Install splice plates and snap-on covers.
- E. Protect finished items from damage for balance of construction period.
 1. Repair/replace damaged items.

3.11 INSTALLATION - WALKWAYS

- A. Install rubber pavers at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as indicated.
 1. Do not locate within 10 feet of roof edge.
- B. Secure as recommended by membrane manufacturer.

3.12 DAILY SEAL

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
 1. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.
- B. Remove temporary water cutoffs prior to proceeding with next work period.
 1. Remove and replace wet insulation.

3.13 CLEAN UP

- A. All debris must be disposed of in a legally acceptable manner.
- B. A representative of manufacturer shall make an inspection and issue written report to Architect that roofing system has been installed properly.

- - - E N D - - -

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Formed sheet metal work for flashing and insulated expansion joint covers are specified in this section.

1.2 RELATED WORK

- A. Composition base flashings and stripping in metal roof flanges: Section 07 54 23, TPO ROOFING.
- B. Flashing components of factory finished roofing and wall systems: Section 07 40 00, ROOFING AND SIDING PANELS.
- C. Sealant compound and installation: Section 07 92 00, JOINT SEALANTS.
- D. Color of factory coated metal and anodized aluminum: Section 09 06 00, SCHEDULE FOR FINISHES.
- E. Integral flashing component of manufactured roof specialties and accessories or equipment: Section 07 71 00, ROOF SPECIALTIES Section 07 72 00, ROOF ACCESSORIES, and Division 22, PLUMBING.
- F. Paint materials and application: Section 09 91 00, PAINTING.
- G. Flashing of Roof Drains: Section 22 05 33, HEAT TRACING FOR PLUMBING PIPING, Section 22 14 00, FACILITY STORM DRAINAGE.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
 - Flashings
 - Copings
 - Gravel Stop-Fascia
 - Gutter and Conductors
 - Expansion joints
 - Fascia-cant
- C. Manufacturer's Literature and Data:
 - Two-piece counterflashing
 - Thru wall flashing
 - Expansion joint cover, each type
 - Nonreinforced, elastomeric sheeting
 - Fascia-cant
 - Self-adhering membrane

D. Certificates: Stating that aluminum has been given - specified finish.
Coating formulators approvals as specified.

E. LEED Information:

1. LEED Credit MR 4.1 and MR 4.2, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating costs for each product having recycled content.
2. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.
 - a. Include statement indicating costs for each product submitted.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below for a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

- A167-99(R 2004).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip
- A653/A653M-07.....Steel Sheet Zinc-Coated (Galvanized) or Zinc
Alloy Coated (Galvanized) by the Hot- Dip
Process
- B32-04.....Solder Metal
- B209-07.....Aluminum and Aluminum-Alloy Sheet and Plate
- B370-03.....Copper Sheet and Strip for Building
Construction
- D173-03.....Bitumen-Saturated Cotton Fabrics Used in
Roofing and Waterproofing
- D412-06.....Vulcanized Rubber and Thermoplastic Elastomers-
Tension
- D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective
Coatings for Metal
- D1784-07.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and
Chlorinated Poly (Vinyl Chloride) (CPVC)
Compounds
- D3656-07.....Insect Screening and Louver Cloth Woven from
Vinyl-Coated Glass Yarns

D4586-07.....Asphalt Roof Cement, Asbestos Free

C. American National Standards Institute/Single Ply Roofing Institute
(ANSI/SPRI):

ES-1-2003.....Wind Design Standard for Edge Systems Used with
Low Slope Roofing Systems

D. Sheet Metal and Air Conditioning Contractors National Association
(SMACNA): Architectural Sheet Metal Manual (2003 Edition).

E. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-505-88.....Metal Finishes Manual

F. American Architectural Manufacturers Association (AAMA):
605-98.....Voluntary Specification for High Performance
Organic Coatings on Architectural Extrusions
Panels

G. Federal Specification (Fed. Spec):
A-A-1925A.....Shield, Expansion; (Nail Anchors)
UU-B-790A.....Building Paper, Vegetable Fiber

H. International Building Code (IBC):
2007 Edition

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A167, Type 302B, dead soft temper.
- B. Aluminum Sheet: ASTM B209, alloy 3003-H14. Except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.
- C. Galvanized Sheet: ASTM, A653.
- D. Nonreinforced, Elastomeric Sheet: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheet shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheet shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).
- E. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m² (6 lbs/100 sf).
- F. Bituminous Paint: ASTM D1187, Type I.

G. Fasteners:

1. Stainless steel for stainless steel. Use galvanized steel or stainless steel for galvanized steel.
2. Nails:
 - a. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
 - b. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
3. Rivets: Not less than 3 mm (1/8 inch) diameter.
4. Expansion Shields: Fed Spec A-A-1925A.

H. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

I. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

J. Roof Cement: ASTM D4586.

K. Self-adhering Membrane: ASTM D1970; cold-applied, composed of a high density, cross laminated polyethylene film coated on one side with a layer of rubberized asphalt adhesive.

2.2 SHEET METAL THICKNESS

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
 1. Stainless steel: 0.25 mm (0.010 inch) thick.
- C. Exposed Locations:
 1. Stainless steel: 0.4 mm (0.015 inch).
- D. Thickness of aluminum or galvanized steel is specified with each item.

2.3 FABRICATION, GENERAL

A. Jointing:

1. In general, stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
 - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
 - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
 - c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.

4. Flat and lap joints shall be made in direction of flow.

5. Soldering:

- a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of stainless steel.
- b. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
- c. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
5. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6 mm (0.024 inch) thick stainless steel.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.

5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC 2006.

G. Metal Options:

1. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

2.4 FINISH

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
 1. Aluminum: Clear anodized.

2.5 THROUGH-WALL FLASHINGS

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
 1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
 2. Fabricate so keying nests at overlaps.

- B. For Masonry Work When Concealed Except for Drip:
1. Aluminum.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
 3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
1. Use same metal and thickness as counter flashing.
 2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
 3. Form exposed portion as snap lock receiver for counter flashing upper edge.
- D. For Flashing at Architectural Precast Concrete Panels or Stone Panels.
1. Use plan flat sheet of aluminum.
 2. Form exposed portions with drip as specified or receiver.
- E. Window Sill Flashing and Lintel Flashing:
1. Use aluminum plane flat sheet.
 2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
 3. Turn up back edge as shown.
 4. Form exposed portion with drip as specified or receiver.
- F. Door Sill Flashing:
1. Where concealed, use 0.5 mm (0.018 inch) thick aluminum.
 2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use 0.6 mm (0.024 inch) aluminum.
 3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.6 BASE FLASHING

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
1. Use aluminum in thickness specified unless specified otherwise.
 2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use 0.5 mm (0.018 inch) aluminum.
 3. Use aluminum at aluminum roof curbs where flashing contacts the aluminum.
 4. Use stainless steel at pipe flashings.
- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
- E. Pipe Flashing: (Other than engine exhaust or flue stack)
 - 1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
 - 2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
 - 3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
 - a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
 - b. Allow for loose fit around and into the pipe.
 - 4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
 - a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
 - b. Allow for loose fit around pipe.

2.7 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. Aluminum, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
 - 1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
 - 2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
 - 3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
 - 4. Manufactured assemblies may be used.
 - 5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
 - 6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
- C. One-piece Counterflashing:

1. Back edge turned up and fabricate to lock into reglet in concrete.
2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:

1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:

1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:

1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.33 mm (0.013 inch) thick aluminum.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

- G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.8 GRAVEL STOPS

A. General:

1. Fabricate in lengths not less than 2400 mm (8 feet) long and maximum of 3000 mm (10 feet).
 2. Fabricate internal and external corners as one-piece with legs not less than 600 mm (2 feet) or more than 1200 mm (4 feet) long.
 3. Fabricate roof flange not less than 100 mm (4 inches) wide.
 4. Fabricate top edge to extend above roof not less than 25 mm (one inch) for embedded gravel aggregate and not less than 100 mm (4 inches) for loose laid ballast.
 5. Fabricate lower edge outward at an angle of 45 degrees to form drip and as fascia or as counter flashing as shown:
 - a. Fabricate of one-piece material of suitable width for fascia height of 250 mm (10 inch) maximum or counterflashing lap of not less than 100 mm (4 inch) over base flashing.
 - b. Fabricate bottom edge of formed fascia to receive edge strip.
 - c. When fascia bottom edge forms counter flashing over roofing lap roofing not less than 150 mm (6 inches).
- B. Formed Flat Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 0.05 mm (0.018 inch) thick stainless steel.
 2. When fascia exceeds 150 mm (6 inches) in depth, form one or more horizontal stops not less than 13 mm (1/2 inch) high in the fascia.
 3. Fabricate as two-piece fascia when fascia depth exceeds 250 mm (10 inches).
 4. At joint between ends of sheets, provide a concealed clip soldered or welded near one end of each sheet to hold the adjoining sheet in lapped position. The clip shall be approximately 100 mm (4 inches) wide and shall be the full depth of the fascia less 25 mm (one inch) at top and bottom. Clip shall be of the same thickness as the fascia.
 5. Provide edge strip as specified with lower hooked edge bent outward at an angle of 45 degrees.
- C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 0.4 mm (0.015 inch) thick aluminum.
 2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
 3. Factory fabricate prepackaged system, complete with fastenings.

4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

2.9 CONDUCTORS (DOWNSPOUTS)

- A. Fabricate conductors of same metal and thickness as gutters in sections approximately 3000 mm (10 feet) long with 19 mm (3/4 inch) wide flat locked seams.
- B. Fabricate open face channel shape with hemmed longitudinal edges.
- C. Fabricate elbows by mitering, riveting, and soldering except seal aluminum in lieu of solder. Lap upper section to the inside of the lower piece.
- D. Fabricate conductor brackets or hangers of same material as conductor, 2 mm (1/16 inch) thick by 25 mm (one inch) minimum width. Form to support conductors 25 mm (one inch) from wall surface in accordance with Architectural Sheet Metal Manual Plate 34, Design C for rectangular shapes and E for round shapes.
- E. Conductor Heads:
 1. Fabricate of same material as conductor.
 2. Fabricate conductor heads to not less than 250 mm (10 inch) wide by 200 mm (8 inch) deep by 200 mm (8 inches) from front to back.
 3. Form front and side edges channel shape not less than 13 mm (1/2 inch) wide flanges with edge hemmed.
 4. Slope bottom to sleeve to conductor or downspout at not less than 60 degree angle.
 5. Extend wall edge not less than 25 mm (one inch) above front edge.
 6. Solder joints for water tight assembly.
 7. Fabricate outlet tube or sleeve at bottom not less than 50 mm (2 inches) long to insert into conductor.

2.10 SPLASHPANS

- A. Fabricate of 0.4 mm (0.015 inch) thick aluminum.
- B. Fabricate in accordance with Architectural Sheet Metal Manual Plate 35 with not less than two ribs as shown in alternate section.

2.11 REGLETS

- A. Fabricate reglets of one of the following materials:
 2. Aluminum, not less than 0.3 mm (0.012 inch) thick.

- B. Fill open-type reglets with fiberboard or other suitable separator, to prevent crushing of the slot during installation.
- C. Bend edges of reglets for setting into concrete to an angle of not less than 45 degrees, and make wide enough to provide firm anchorage in the concrete.
- D. Fabricate reglets for building into horizontal masonry mortar joints not less than 19 mm (3/4 inch) deep, nor more than 25 mm (one inch) deep.
- E. Fabricate mitered corners, fittings, and special shapes as may be required by details.
- F. Reglets for concrete may be formed to receive flashing and have a 10 mm (3/8 inch), 45 degree snap lock.

2.12 INSULATED EXPANSION JOINT COVERS

- A. Either type optional, use only one type throughout.
- B. Types:
 - 1. Construct of two preformed, stainless steel strips, not less than 0.4 mm (0.015 inch) thick, mechanically and adhesively bonded to both sides of a 2 mm (1/16 inch) thick neoprene or butyl sheet, or to a 0.4 mm (32 mil) thick reinforced chlorinated polyethylene sheet. Adhesively attach a 10 mm (3/8 inch) thick sheet of closed cell, neoprene foam insulation, to the underside of the neoprene, butyl, or chlorinated polyethylene sheet.
 - 2. Constructed of a 2 mm (1/16 inch) thick vinyl sheet, flanged at both sides with stainless steel strips not less than 0.4 mm (0.015 inch) thick. Vinyl sheet locked and encased by the stainless steel strip and prepunched for nailing. A 10 mm (3/8 inch) thick closed cell polyvinyl chloride foam insulating strip shall be heat laminated to the underside of the vinyl sheet between the stainless steel strips.
- C. Expansion joint covers shall have factory fabricated mitered corners crossing, tees and other necessary accessories. Furnish in the longest available lengths.
- D. Metal flange of sufficient width to extend over the top of the curb and down curb sides 50 mm (2 inches) with hemmed edge for lock to edge strip.

2.13 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING

- A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.

- B. Fabricate collar with roof flange of 1.2 mm (0.047 inch) minimum thick black iron or galvanized steel sheet.
1. Fabricate inside diameter of collar 100 mm (4 inches) larger than the outside diameter of the item penetration the roofing.
 2. Extend collar height from structural roof deck to not less than 350 mm (14 inches) above roof surface.
 3. Fabricate collar roof flange not less than 100 mm (4 inches) wide.
 4. Option: Collar may be of steel tubing 3 mm (0.125 inch) minimum wall thickness, with not less than four, 50 mm x 100 mm x 3 mm (2 inch by 4 inch by 0.125 inch) thick tabs bottom edge evenly spaced around tube in lieu of continuous roof flange. Full butt weld joints of collar.
- C. Fabricate sleeve base flashing with roof flange of stainless steel.
1. Fabricate sleeve roof flange not less than 100 mm (4 inches) wide.
 2. Extend sleeve around collar up to top of collar.
 3. Flange bottom of sleeve out not less than 13 mm (1/24 inch) and soldered to 100 mm (4 inch) wide flange to make watertight.
 4. Fabricate interior diameter 50 mm (2 inch) greater than collar.
- D. Fabricate hood counter flashing from same material and thickness as sleeve.
1. Fabricate the same as pipe counter flashing except allow not less than 100 mm (4 inch) lap below top of sleeve and to form vent space minimum of 100 mm (4 inch) wide.
 2. Hem bottom edge of hood 13 mm (1/2 inch).
 3. Provide a 50 mm (2 inch) deep drawband.
- E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

2.14 GOOSENECK ROOF VENTILATORS

- A. Form of 1.3 mm (0.0508 inch) thick sheet aluminum, reinforce as necessary for rigidity, stiffness, and connection to curb, and to be watertight.
1. Form lower-edge to sleeve to curb.
 2. Curb:
 - a. Form for 100 mm (4 inch) high sleeve to ventilator.
 - b. Form for concealed anchorage to structural curb and to bear on structural curb.
 - c. Form bottom edge of curb as counterflashing to lap base flashing.

B. Provide open end with 1.6 mm (16 gage), stainless steel wire guard of 13 mm (1/2 inch) square mesh.

1. Construct suitable aluminum angle frame to retain wire guard.
2. Rivet angle frame to end of gooseneck.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
7. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
8. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
9. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
10. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.

11. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
12. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.

3.2 THROUGH-WALL FLASHING

A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.
3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.

13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
 - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
 - b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).
- B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.
- C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).
- D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.
- E. Flashing at Veneer Walls:
 1. Install near line of finish floors over shelf angles or where shown.
 2. Turn up against sheathing.
 3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
 4. At concrete backing, extend flashing into reglet as specified.
 5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- F. Lintel Flashing when not part of shelf angle flashing:
 1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
 2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
 3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.
- G. Window Sill Flashing:

1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
2. Turn back edge up to terminate under window frame.
3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:

1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

3.3 BASE FLASHING

- A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
 2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
 3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
 4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.
- B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

- C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.

B. One Piece Counterflashing:

1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
3. Where flashing is surface mounted on flat surfaces.
 - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
 - 1) Locate fasteners in masonry mortar joints.
 - 2) Use screws to sheet metal or wood.
 - b. Fill joint at top with sealant.
4. Where flashing or hood is mounted on pipe.
 - a. Secure with draw band tight against pipe.
 - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
 - c. Completely fill joint at top with sealant.

C. Two-Piece Counterflashing:

1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
2. Surface applied type receiver:
 - a. Secure to face construction in accordance, with manufacturers instructions.
 - b. Completely fill space at the top edge of receiver with sealant.
3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

3.5 REGLETS

- A. Install reglets in a manner to provide a watertight installation.
- B. Locate reglets not less than 225 mm (9 inch) nor more than 400 mm (16 inch) above roofing, and not less than 125 mm (5 inch) nor more than 325 mm (13 inch) above cant strip.
- C. Butt and align end joints on each section of reglet and securely hold in position until concrete or mortar are hardened:
 1. Coordinate reglets for anchorage into concrete with formwork construction.
 2. Coordinate reglets for masonry to locate horizontally into mortar joints.

3.6 GRAVEL STOPS

- A. General:
 1. Install gravel stops and fascias with allowance for expansion at each joint; minimum of 6 mm (1/4 inch).
 2. Extend roof flange of gravel stop and splice plates not less than four inches out over roofing and nail or screw to wood nailers. Space fasteners on 75 mm (3 inch) centers in staggered pattern.
 3. Install continuous cleat for fascia drip edge. Secure with fasteners as close to lower edge as possible on 75 mm (3 inch) centers.
 4. Where ends of gravel stops and fascias abut a vertical wall, provide a watertight, flashed and sealant filled joint.
 5. Set flange in roof cement when installed over built-up roofing.
 6. Edge securement for low-slope roofs: Low-slope membrane roof systems metal edge securement, except gutters, shall be designed in

accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609, of IBC 2006.

B. Sheet metal gravel stops and fascia:

1. Install with end joints of splice plates sheets lapped three inches.
2. Hook the lower edge of fascia into a continuous edge strip.
3. Lock top section to bottom section for two piece fascia.

C. Corrugated sheet gravel stops and fascia:

1. Install 300 mm (12 inch) wide sheet flashing centered under joint. A combination bottom and cover plate, extending above and beneath the joint, may be used.
2. Hook lower edge of fascia into a continuous edge strip.

D. Scuppers:

1. Install scupper with flange behind gravel stops; leave 6 mm (1/4 inch) joint to gravel stop.
2. Set scupper at roof water line and fasten to wood blocking.
3. Use sealant to seal joint with fascia gravel stops at ends.
4. Coordinate to lap over conductor head and to discharge water into conductor head.

3.7 COPINGS

A. General:

1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

B. Stainless Steel Copings:

1. Join ends of sheets by a 19 mm (3/4 inch) locked and soldered seam, except at intervals of 9600 mm (32 feet), provide a 38 mm (1 1/2 inch) loose locked expansion joint filled with sealant or mastic.
2. At straight runs between 7200 mm (24 feet) and 19200 mm (64 feet) locate expansion joint at center.
3. At straight runs that exceed 9600 mm (32 feet) and form the leg of a corner locate the expansion joint not more than 4800 mm (16 feet) from the corner.

3.8 EXPANSION JOINT COVERS, INSULATED

- A. Install insulated expansion joint covers at locations shown on curbs not less than 200 mm (8 inch) high above roof surface.
- B. Install continuous edge strips of same metal as expansion joint flange, nailed at not less than 75 mm (3 inch) centers.
- C. Install insulated expansion joint covers in accordance with manufacturer's directions locking edges to edge strips.

3.9 ENGINE EXHAUST PIPE OR STACK FLASHING

- A. Set collar where shown and secure roof tabs or flange of collar to structural deck with 13 mm (1/2 inch) diameter bolts.
- B. Set flange of sleeve base flashing not less than 100 mm (4 inch) beyond collar on all sides as specified for base flashing.
- C. Install hood to above the top of the sleeve 50 mm (2 inch) and to extend from sleeve same distance as space between collar and sleeve beyond edge not sleeve:
 - 1. Install insect screen to fit between bottom edge of hood and side of sleeve.
 - 2. Set collar of hood in high temperature sealant and secure with one by 3 mm (1/8 inch) bolt on stainless steel draw band type, or stainless steel worm gear type clamp. Install sealant at top of head.

3.10 CONDUCTORS (DOWNSPOUTS)

- A. Where scuppers discharge into downspouts install conductor head to receive discharge with back edge up behind drip edge of scupper. Fasten and seal joint. Sleeve conductors to gutter outlet tubes and fasten joint and joints between sections.
- B. Set conductors plumb and clear of wall, and anchor to wall with two anchor straps, located near top and bottom of each section of conductor. Strap at top shall be fixed to downspout, intermediate straps and strap at bottom shall be slotted to allow not less than 13 mm (1/2 inch) movement for each 3000 mm (10 feet) of downspout.
- C. Install elbows, offsets and shoes where shown and required. Slope not less than 45 degrees.

3.11 SPLASH PANS

- A. Install where downspouts discharge on low slope roofs unless shown otherwise.
- B. Set in roof cement prior to pour coat installation or sealant compatible with single ply roofing membrane.

3.12 GOOSENECK ROOF VENTILATORS

- A. Install on structural curb not less than 200 mm (8 inch) high above roof surface.
- B. Securely anchor ventilator curb to structural curb with fasteners spaced not over 300 mm (12 inch) on center.
- C. Anchor gooseneck to curb with screws having nonprene washers at 150 mm (6 inch) on center.

- - - E N D - - -

SECTION 07 71 00
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies roof hatches; equipment supports.

1.2 RELATED WORK

- A. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES.
Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- B. General insulation: Section 07 21 13, THERMAL INSULATION. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

1.3 QUALITY CONTROL

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of anodizing.
- F. LEED Information:
1. LEED Credit MR 4.1 and MR 4.2, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 2. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.

- a. Include statement indicating costs for each product submitted.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
RR-G-1602D.....Grating, Metal, Other Than Bar Type (Floor,
Except for Naval Vessels)
- C. American Society for Testing and Material (ASTM):
A653/A653M-02.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-
Iron Alloy-Coated (Galvannealed) By the Hot-Dip
Process
B209/209M-02.....Aluminum and Aluminum Alloy-Sheet and Plate
B221/221M-02.....Aluminum-Alloy Extruded Bars, Rods, Wire,
Shapes, and Tubes
C612-00.....Mineral Fiber Block and Board Thermal Insulation
D1187-97.....Asphalt-Base Emulsions for Use as Protective
Coatings for Metal
- D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
- E. American Architectural Manufacturers Association (AAMA):
605-98.....High Performance Organic Coatings on
Architectural Extrusions and Panels.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.
- C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.
- D. Metal Grating for Roof Walkway: Fed. Spec. RR-G-1602.

2.2 ROOF HATCH (SCUTTLE)

- A. Fabricate from steel, zinc coated, galvanized.
- B. Curb and Cover:
1. Curb facing: Minimum 14 GA steel sheet.
 2. Cover facing: Minimum 14 GA steel sheet.
 3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and curb.
 4. Form exterior curb facing with an integral 3-1/2 inch wide roof flange and cover with 2-1/2 inch weather flange.
 5. Make curb 300 mm (12 inches).
 6. Form cover to lap curb and cap flashing.

7. Size opening as shown.

C. Hardware:

1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long.
2. Provide pintle hinges.
3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
4. Covers shall automatically lock in the open position at not less than 70 degrees.
5. Provide gasket at cover closure.
6. All hardware items cadmium plated.

D. Hatch Guardrail System:

1. Use appropriate model number according to hatch size and ladder position.
2. Integral color: High visibility safety yellow color.
3. Hatch rail system shall attach to the capflashing of the roof hatch without penetrating roofing material.
4. Comply with OSHA 29 CFR 1910.23.
5. Exceed OSHA strength requirements with a factor of safety of 2.
6. Hardware:
 - a. Mounting brackets: 1/4 inch thick hot dip galvanized steel.
 - b. Hinges and post guides: 6063T5 aluminum.
 - c. Fasteners: Type 316 stainless steel.
7. Gate:
 - a. Self-closing design of material matching balance of guardrail system.

E. Assembly:

1. Completely shop assemble roof scuttle.
2. Fully weld all joints exposed to the weather and built into the roofing.
3. Finish weld smooth where exposed.
4. Operation with minimum force to open and close.

2.3 EQUIPMENT SUPPORTS

- A. Fabricate equipment supports from 1.3 mm (0.0516 inch) thick galvanized steel.
- B. Form exterior curb with integral base, and deck closures for curbs installed on steel decking.
- C. Use galvanized steel liners for curbs having inside dimension over 305 mm (12 inches).

- D. Fabricate curb with a minimum height of 200 mm (8 inches) above roof surface.
- E. Attach preservative treated wood nailers to top of curb. Use 50 mm (2 inch) by 50 mm (2 inch) minimum nominal size on curb with openings and 50 mm (2 inch) thick, width of curb up to 300 mm (12 inches) on equipment support curbs.
- F. Make size of supports suit size of equipment furnished, with height as shown on drawings, but not less than 200 mm (8 inches) above roof surface.

2.4 FINISH

- A. In accordance with NAAMM Amp 500 Series.
- B. Aluminum, Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1, Architectural, 0.7 mils thick.
- C. Aluminum Colored Finish: AA-C22A42 (anodized or AA0C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1, Architectural, 0.7 mils thick. Dyes will not be accepted.
- D. Fluorocarbon Finish: AAMA 605.2 high performance organic coating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof specialties where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
 - a. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
 - b. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
 - c. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).
- F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

3.2 PROTECTION OF ALUMINUM

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.

3.4 PROTECTION

- A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies copings, gravel stops, fascias, and expansion joints.

1.2 RELATED WORK

- A. Color and texture of finish: Section 09 06 00, SCHEDULE FOR FINISHES
- B. Sealant material and installation: Section 07 92 00, JOINT SEALANTS.
- C. General insulation: Section 07 21 13, THERMAL INSULATION
- D. Rigid insulations for roofing: Section 07 22 00, ROOF AND DECK INSULATION

1.3 QUALITY CONTROL

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Representative sample panel of fluorocarbon finish aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of fluorocarbon finish.
- F. LEED Information:
 - 1. LEED Credit MR 4.1 and MR 4.2, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating costs for each product having recycled content.

2. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.
- a. Include statement indicating costs for each product submitted.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Material (ASTM):
- B209/209M-07.....Aluminum and Aluminum Alloy-Sheet and Plate
- B221/221M-07.....Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- C612-04.....Mineral Fiber Block and Board Thermal Insulation
- D1187-97 (R2002).....Asphalt-Base Emulsions for Use as Protective Coatings for Metal
- C. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500-505-88.....Metal Finishes Manual
- D. American Architectural Manufacturers Association (AAMA):
- 605-98.....High Performance Organic Coatings on Architectural Extrusions and Panels.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.
- C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.
- D. Insulation: ASTM C612, Class 1 or 2.
- E. Asphalt Coating: ASTM D 1187, Type I, quick setting.

2.2 COPINGS

- A. Fabricate of aluminum not less than 3.2 mm (0.125 inch) thick; or 0.5 mm (0.018 inch) thick stainless steel.
- B. Turn outer edges down each face of wall as shown.
- C. Maximum lengths of 3000 mm (10 feet).
- D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.
- E. Copings shall be Category 5 FM rated.
- F. Provide 100 mm (four inch) wide 0.8 mm (0.032 inch) thick watertight joint covers.
- G. Provide anchor gutter bar of 0.8 mm (0.032 inch) thick with anchor holes formed for underside of joint.

H. Provide concealed guttered splice plate of 0.8 mm (0.032 inch) thick with butyl or other resilient seal strips anchored to splice plate for underside of joint. Use galvanized steel anchor plate providing compression spring anchoring of coping cover.

I. Finish: Fluorocarbon as specified.

2.3 EXTRUDED ALUMINUM GRAVEL STOPS AND FASCIAS

- A. Fabricate of aluminum not less than 2 mm (0.078 inch) thick.
- B. Turn fascia down face of wall and up above roof as shown.
- C. Maximum lengths of 3000 mm (10-feet).
- D. Shop fabricate external and internal corners as one piece assemblies with not less than 300 mm (12 inch) leg lengths.
- E. Provide 100 mm (four inch) wide 2 mm (0.078 inch) thick watertight joint covers with 150 mm (six inch) wide 0.8 mm (0.030 inch) thick underside joint flashing.

2.4 EXTRUDED ALUMINUM FASCIA-CANT SYSTEM

- A. The fascia-cant system consists of three pieces, an extruded aluminum fascia, a galvanized steel cant, and an aluminum compression clamp.
- B. Furnish in stock lengths of not more than 3000 mm (10 feet) long.
- C. Form fascia from not less than 2 mm (0.070 inch) thick aluminum. Provide four inch wide 0.8 mm (0.032-inch) thick concealed sheet aluminum joint cover plates in back of fascia.
- D. Form cant strip from galvanized steel not less than 0.8 mm (0.0299 inch) thick, to profile shown and design to hold lower edge of the fascia.
- E. Form compression clamp of not less than 0.8 mm (0.032 inch) thick aluminum designed to hold the top edge of the fascia and the built-up flashing.
- F. Internal and external corners:
 - 1. Factory fabricate and fully weld mitered joints.
 - 2. Furnish corner sections in manufacturers standard sizes with not less than 300 mm (12 inch) leg lengths.
- G. Finish on aluminum: Fluorocarbon as specified.

2.5 EXTRUDED ALUMINUM ROOF EXPANSION JOINT COVERS

- A. Fabricate in 3000 mm (10 foot) lengths with fastener openings slotting for expansion not over 600 mm (24 inch) centers.
- B. Provide four-way expansion, for joint widths shown.
- C. Fluorocarbon finish on aluminum. Manufacturer's standard colors.
- D. Form waterstop or moisture seals of continuous sheets of neoprene, not less than 0.8 mm (0.032 inch) thick.
- E. Fabricate corners as one piece assembly with mitered and welded joint and least dimension legs not less than 300 mm (12 inches) long.

F. Factory fabricate end caps and transitions to insure waterproof assembly.

G. Three piece assembly:

1. Roof expansion joint cover system consists of an extruded aluminum cover, extruded frame or curb vertical section, galvanized steel cant, and aluminum compression clamp counter flashing, complete with moisture seals. Form cover and vertical section from extruded aluminum, 2 mm (0.080 inch) minimum thickness with spring stainless steel tension or pivot bar.
2. Form cant from galvanized steel not less than 0.8 (0.029 inch) thick formed to profile shown.
3. Form splice plates of not less than 0.8 mm (0.032 inch) thick aluminum sheet.
4. Form counter flashing member of 1.3 mm (0.050 inch) thick sheet aluminum, secured with screws to the top edge of the vertical section and providing compression clamp over base flashing.
5. Provide compression gasket separating cover from curb bearing.

H. Two piece assembly:

1. Roof expansion joint system consists of an extruded aluminum cover combination extruded aluminum frame or curb with integral adjustable counter flashing flange, and moisture seals.
2. Form cover from extruded aluminum 2 mm (0.078 inch) minimum thickness.
3. Form cover anchor system of stainless steel pivot bar.
4. Form frame assembly of not less than 2 mm (0.076 inch) aluminum except for flashing portion.
5. Provide compression gasket separating cover from curb at bearing.

2.6 FINISH

- A. In accordance with NAAMM Amp 500-505.
- B. Aluminum, Mill Finish: AA-MIX, as fabricated.
- C. Aluminum, Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1, Architectural, 0.7 mils thick.
- D. Aluminum Colored Finish: AA-C22A42 (anodized or AA0C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1, Architectural, 0.7 mils thick. Dyes will not be accepted.
- E. Fluorocarbon Finish: AAMA 605.2 high performance organic coating, 1 mil thick, 70% PVDF (Kynar/Hylar). Custom colors.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install roof accessories where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section 07 21 13, THERMAL INSULATION and Section 07 22 00, ROOF AND DECK INSULATION.
- D. Comply with section 07 92 00, JOINT SEALANTS to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
- F. Gravel Stops and Fascias:
 - 1. Install gravel stops and fascia with butt joints with approximately 6 mm (1/4 inch) space for expansion.
 - 2. Over each joint provide cover plates of sheet aluminum, complete with concealed sheet aluminum flashing, centered under each joint.
 - 3. Lap cover plates and concealed flashing over the gravel stop and fascia not less than four inches.
 - 4. Extend concealed flashing over TPO roofing, cover, with pressure-sensitive cover strip, and turn down over face of blocking at roof edge.
- G. Aluminum Coping:
 - 1. Install sections of coping with approximately 6 mm (1/4-inch) space between ends of sections.
 - 2. Center joint gutter bar and covers at joints and securely lock in place.
 - 3. When snap-on system is used insure front and back edges are locked in place.
- H. Fascia-Cant System:
 - 1. Install galvanized steel cant; coordinate with roofing work and after completion of roofing work install extruded aluminum fascia, concealed joint cover plate, and aluminum compression clamp, where shown.
 - 2. Install system to allow for expansion and contraction with 6 mm (1/4 inch) space between extruded aluminum members and galvanized steel cant as required by manufacturer of system.
 - 3. Offset joints in extruded aluminum members from galvanized steel cant joints.

I. Expansion Joint Covers:

1. Install to terminate base flashing 200 mm (8 inches) above roof.
2. Install moisture seals to drain water to outlets that do not permit water to enter buildings construction.
3. Use stainless steel screws when exposed.
4. Three piece assembly:
 - a. Install curb section with screws to wood blocking, allowing 6 mm (1/4 inch) at butt joints between sections with splice plate at joint.
 - b. Install cant to wood blocking by nailing along horizontal flange every 150 mm (6 inches), with galvanized roofing nails 25 mm (one inch) long.
 - c. After completion of base flashing install cap flashing and compression clamp and fasten to the curb or metal cant with stainless steel self-tapping screws with neoprene washers under head spaced approximately 450 mm (18 inches) on center.
 - d. Install expansion joint cover with a 6 mm (1/4 inch) wide end joints.
 - e. Install over end joint a cover plate complete with concealed aluminum flashing, centered under each joint. Fabricate flashing to lap cover not less than four inches.
5. Two piece assembly:
 - a. Install curb section with screws allowing 6 mm (1/4 inch) space at end joints with splice plate at joint.
 - b. After completion of base flashing bend down cap flashing flange and secure to blocking with screws.
 - c. Install expansion joint cover with 6 mm (1/4 inch) wide space at end joints and tension bars at 600 mm (24 inches) on center.
 - d. Install cover plates with formed aluminum flashing concealed and centered on joint. Flashing to lap cover not less than 100 mm (4 inches).

3.2 PROTECTION OF ALUMINUM

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

- A. Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.4 PROTECTION

- A. Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Manufacturer's complete and detailed application instructions and specifications.
 - 2. Manufacturer's repair and patching instructions.
- C. Certificates:
 - 1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
 - a. List thickness and density of material required to meet fire ratings.
 - b. Accompanied by complete test report and test record.
 - 2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.
- D. Miscellaneous:
 - 1. Manufacturer's written approval of surfaces to receive sprayed-on cementitious fireproofing.
 - 2. Manufacturer's written approval of completed installation.
 - 3. Manufacturer's written approval of the applicators of fireproofing material.
- E. LEED Information:
 - 1. LEED Credit MR 4.1 and MR 4.2, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.

- a. Include statement indicating costs for each product submitted.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.
- B. Remove damaged containers from the site.
- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.
- E. Remove materials that have been exposed to water before installation from the site.

1.4 QUALITY CONTROL

- A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.
- C. Manufacturer's approval of fireproofing applications.
- D. Manufacturer's approval of completed installation.
- E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.
- F. Pre-Application Test Area.
 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
 - a. Apply to one column.
 - b. Apply for the hourly ratings used.
 2. Install in location selected by the Resident Engineer, for approval by the representative of the fireproofing material manufacturer and by the Government.
 3. Perform Bond test on painted steel in accordance with ASTM E736.
 4. Do not proceed in other areas until installation of test area has been completed and approved.
 5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- C841-03.....Installation of Interior Lathing and Furring
 - C847-06.....Metal Lath
 - E84-08.....Surface Burning Characteristics of Building Materials
 - E119-08.....Fire Tests of Building Construction and Materials
 - E605-93 (R2006).....Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members
 - E736-00.....Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - E759-92 (R2005).....The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
 - E760-92 (R2005).....Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
 - E761-92 (R2005).....Compressive Strength of Fire-Resistive Material Applied to Structural Members
 - E859-93 (R2006).....Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - E937-93 (R2005).....Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members
 - E1042-02.....Acoustically, Absorptive Materials Applied by Trowel or Spray.
 - G21-96 (R2002).....Determining Resistance of Synthetic Polymeric Materials to Fungi
- C. Underwriters Laboratories, Inc. (UL):
- Fire Resistance Directory...Latest Edition including Supplements
- D. Warnock Hersey (WH):
- Certification Listings..Latest Edition
- E. Factory Mutual System (FM):
- Approval Guide.....Latest Edition including Supplements

PART 2 - PRODUCTS**2.1 SPRAYED-ON FIREPROOFING**

A. ASTM E1042, Class (a), Category A.

1. Type I, factory mixed cementitious materials with approved aggregate.

B. Materials containing asbestos are not permitted.

C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft ²) for protected areas. 19.15 kPa (400 lbf/ft ²) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27gm/m ² (0.025 gm/ft ²).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 36 kPa (5 lbf/in ²).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE

A. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER

A. Surface burning characteristics as specified for fireproofing material.

B. Fungus resistant.

- C. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

2.4 WATER

- A. Clean, fresh, and free from organic and mineral impurities.
B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL

- A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m² (1.7 pounds per square yard).
B. Fasteners: ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
D. Verify concrete work on steel decking and concrete encased steel is completed.
E. Verify temperature and enclosure conditions are required by fireproofing material manufacturer.

3.2 APPLICATION

- A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.
B. Coordinate application of fireproofing material with other trades.
C. Application of Metal Lath:
1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
2. Apply to beam flanges 300 mm (12-inches) or more in width.
3. Apply to column flanges 400 mm (16-inches) or more in width.
4. Apply to beam or column web 400 mm (16-inches) or more in depth.
5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
6. See design criteria section of the approved assemblies used.

7. Lap and tie lath member in accordance with ASTM C841.
- D. Mix and apply in accordance with manufacturer's instructions.
 1. Mechanically control material and water ratios.
 2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
 3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
 4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purl in or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:
 - a. Type I - 240 kg/m^3 (15 lb/ft^3).
- E. Application shall be completed in one area, inspected and approved by Resident Engineer before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS

- A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Resident Engineer will select area to be tested in specific bays on each floor using a geometric grid pattern.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.
- D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.
 1. Test for cohesion/adhesion: ASTM E736.
 2. Test for bond impact strength: ASTM E760.

3.4 PATCHING AND REPAIRING

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.
 1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
 2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.

3. Hand mixing of material is not permitted.

C. Repair:

1. Respray all test and rejected areas.

2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

3.5 SCHEDULE

A. Apply fireproofing material in interior structural steel members and on underside of interior steel floor and roof decks, except on following surfaces:

1. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms.

2. Steel members in elevator hoist ways.

3. Areas used as air handling plenums.

4. Steel to be encased in concrete or designated to receive other type of fireproofing.

B. Type I:

1. One hour fire rating.

2. Two hour fire rating.

3. Three hour fire rating.

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SECTION 07 84 00
FIRESTOPPING**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

- A. Expansion and seismic joint firestopping: Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.
- B. Spray applied fireproofing: Section 07 81 00, APPLIED FIREPROOFING
- C. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- D. Fire and smoke damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS Section 23 37 00, AIR OUTLETS AND INLETS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- C. List of FM, UL, or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.
- E. LEED Information:
 - 1. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.
 - a. Include statement indicating costs for each product submitted.
 - 2. LEED Credit EQ 4.1, Low-Emitting Materials, Sealants: Manufacturer's product data for construction sealants, including printed statement of VOC content and Material Safety Data Sheets.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.5 WARRANTY

- A. Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

1.6 QUALITY ASSURANCE

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- E84-07.....Surface Burning Characteristics of Building
Materials
- E814-06.....Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
- Annual Issue Approval Guide Building Materials
- D. Underwriters Laboratories, Inc. (UL):
- Annual Issue Building Materials Directory
- Annual Issue Fire Resistance Directory
- 1479-03.....Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
- Annual Issue Certification Listings

PART 2 - PRODUCTS**2.1 FIRESTOP SYSTEMS**

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m² (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.

- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
1. Contain no flammable or toxic solvents.
 2. Have no dangerous or flammable out gassing during the drying or curing of products.
 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
1. Classified for use with the particular type of penetrating material used.
 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

- A. Use silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

3.2 PREPARATION

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

- A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP AND ACCEPTANCE OF WORK

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the Resident Engineer.
- C. Clean up spills of liquid type materials.

- - - E N D - - -

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK

- A. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- B. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.
- C. Firestopping penetrations: Section 07 84 00, FIRESTOPPING.
- D. Glazing: Section 08 80 00, GLAZING.
- E. Glazed aluminum curtain wall: Section 08 44 13, GLAZED ALUMINUM CURTAIN WALLS.
- F. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.
- G. Mechanical Work: Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

1.3 QUALITY CONTROL

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by

reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
 - 1. Caulking compound
 - 2. Primers
 - 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- E. LEED Information:
 - 1. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.
 - a. Include statement indicating costs for each product submitted.
 - 2. LEED Credit EQ 4.1, Low-Emitting Materials, Sealants: Manufacturer's product data for construction sealants, including printed statement of VOC content and Material Safety Data Sheets.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
 - 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 5° C (40° F) or less than 32° C (90° F).

1.7 DEFINITIONS

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.8 WARRANTY

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material.
 - C612-04.....Mineral Fiber Block and Board Thermal Insulation.
 - C717-07.....Standard Terminology of Building Seals and Sealants.
 - C834-05.....Latex Sealants.
 - C919-02.....Use of Sealants in Acoustical Applications.
 - C920-05.....Elastomeric Joint Sealants.
 - C1021-08.....Laboratories Engaged in Testing of Building Sealants.
 - C1193-05.....Standard Guide for Use of Joint Sealants.

C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold
Liquid Applied Sealants.

D1056-07.....Specification for Flexible Cellular Materials—
Sponge or Expanded Rubber.

E84-08.....Surface Burning Characteristics of Building
Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40
6. VOC content no greater than 250 g/L.

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.
6. VOC content no greater than 250 g/L.

C. S-3:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.
7. VOC content no greater than 250 g/L.

D. S-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-40.

6. VOC content no greater than 250 g/L.

E. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.
7. VOC content no greater than 250 g/L.

F. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.
7. VOC content no greater than 250 g/L.

G. S-8:

1. ASTM C920, silicone, acetoxo cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.
7. VOC content no greater than 250 g/L.

H. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.
7. VOC content no greater than 250 g/L.

I. S-10:

1. ASTM C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.

5. Shore A hardness of 15-20.
6. VOC content no greater than 250 g/L.

J. S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.
6. VOC content no greater than 250 g/L.

K. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.
6. VOC content no greater than 250 g/L.

2.2 CAULKING COMPOUND

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and

capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POUROUS SURFACES

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.

2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 CLEANING

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

3.7 LOCATIONS

- A. Exterior Building Joints, Horizontal and Vertical:
 1. Metal to Metal: Type S-1, S-2
 2. Metal to Masonry or Stone: Type S-1
 3. Masonry to Masonry or Stone: Type S-1
 4. Stone to Stone: Type S-1
 5. Threshold Setting Bed: Type S-1, S-3, S-4
 6. Masonry Expansion and Control Joints: Type S-6
- B. Metal Reglets and Flashings:
 1. Flashings to Wall: Type S-6
 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
 1. Walls to Plumbing Fixtures: Type S-9
 2. Counter Tops to Walls: Type S-9
 3. Pipe Penetrations: Type S-9
- D. Heliport:
 1. Type S-12: Shore A hardness of between 25 and 30 for joints requiring or greater movement range of plus or minus 50 percent.
List spaces where required.
- E. Horizontal Traffic Joints:
 1. Concrete Paving, Unit Pavers: Type S-11 or S-12

F. High Temperature Joints over 204 degrees C (400 degrees F):

1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

G. Interior Caulking:

1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.
2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.
3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.
4. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.
5. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
6. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-3.

- - - E N D - - -

SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies floor, wall and ceiling, seismic and building expansion joint assemblies.
- B. Types of assemblies:
 - 1. Metal Plate Cover
 - 2. Elastomeric Joint Covers
 - 3. Preformed Elastomeric Sealant Joint
 - 4. Pre-molded Compressible Sealant (pre-finished)

1.2 RELATED WORK

- A. Sheet Metal Expansion Joint Seals: Section 07 60 00, FLASHING AND SHEET METAL.
- B. Roof Expansion Joint Cover Assemblies: Section 07 72 00, ROOF ACCESSORIES.
- C. Color of Elastomer Inserts, Filler Strips, Exterior Wall Seals and Metal Finishes: Section 09 06 00, SCHEDULE FOR FINISHES

1.3 QUALITY ASSURANCE

- A. Project Conditions:
 - 1. Check actual locations of walls and other construction, to which work must fit, by accurate field measurements before fabrication.
 - 2. Show recorded measurements on final shop drawings.
- B. Fire tests performed by Factory Mutual, Underwriters Laboratories, Inc., Warnock Hersey or other approved independent testing laboratory.

1.4 DELIVERY STORAGE AND HANDLING

- A. Take care in handling of materials so as not to injure finished surface and components.
- B. Store materials under cover in a dry and clean location off the ground.
- C. Remove materials which are damaged or otherwise not suitable for installation from job site and replace with acceptable materials.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Submit copies of manufacturer's current literature and data for each item specified.

2. Clearly indicate movement capability of cover assemblies and suitability of material used in exterior seals for ultraviolet exposure.
- C. Certificates: Material test reports from approved independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements specified.
- D. Shop Drawings:
 1. Showing full extent of expansion joint cover assemblies; include large-scale details indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joiners with other type assemblies, special end conditions, anchorages, fasteners, and relationship to adjoining work and finishes.
 2. Include description of materials and finishes and installation instructions.
- E. Samples:
 1. Samples of each type and color of metal finish on metal of same thickness and alloy used in work.
 2. Samples of each type and color of flexible seal used in work.
- F. LEED Information:
 1. LEED Credit MR 4.1 and MR 4.2, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 2. LEED Credit MR 5.1 and MR 5.2, Materials Extracted, Processed and Manufactured Regionally: Manufacturer's data identifying point of origin for products procured within a 500 mile radius of the project.
 - a. Include statement indicating costs for each product submitted.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed form part of this specification to extent referenced. Publications are referred to in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
A36/A36M-05.....Structural Steel
A167-99 (R2004).....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip

- A283/A283M-03.....Low and Intermediate Tensile Strength Carbon
Steel Plates
- A786/A786M-05.....Rolled Steel Floor Plates
- B36/B36M-06.....Brass, Plate, Sheet, Strip, and Rolled Bar
- B121-01(R2006).....Leaded Brass Plate, Sheet, Strip and Rolled Bar
- B209M-06.....Aluminum and Aluminum-Alloy Sheet and Plate
(Metric)
- B221M-06.....Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Shapes, and Tubes (Metric)
- B455-05.....Copper-Zinc Lead Alloy (Leaded Brass) Extruded
Shapes
- C864-05.....Dense Elastomeric Compression Seal Gaskets,
Setting Blocks, and Spacers
- C920-05.....Elastomeric Joint Sealants
- D1187-97 (R2002).....Asphalt Base Emulsions for Use as Protective
Coatings for Metal
- D2287-96 (R2001).....Non-rigid Vinyl Chloride Polymer and Copolymer
Molding and Extrusion Compounds
- E119-07.....Fire Tests of Building Construction and
Materials
- E814-06.....Fire Tests of Through-Penetration Fire Stops
- C. Federal Specifications (Fed. Spec):
- TT-P-645B.....Primer, Paint, Zinc-Molybdate, Alkyd Type
- D. The National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 Series.....Metal Finishes Manual.
- E. National Fire Protection Association (NFPA):
- 251-05.....Tests of Fire Endurance of Building
Construction and Materials
- F. Underwriters Laboratories Inc. (UL):
- 263-03.....Fire Tests of Building Construction and
Materials

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Aluminum:
1. Extruded: ASTM B221, alloy 6063-T5.
 2. Plate and Sheet: ASTM B209, alloy 6061-T6.
- B. Elastomeric Sealant:
1. ASTM C920, polyurethane.

2. Type.
 3. Class 25.
 4. Grade P or NS.
 5. Shore A hardness 25, unless specified otherwise.
- C. Thermoplastic Rubber:
1. ASTM C864.
 2. Dense Neoprene or other material standard with expansion joint manufacturers having the same physical properties.
- D. Vinyl Invertor Sealant Waterstops: Manufacturers' standard shapes and grade.
- E. Fire Barrier:
1. Designed for indicated or required dynamic structural movement without material degradation or fatigue.
 2. Tested in maximum joint width condition as a component of an expansion joint cover assembly in accordance with UL 263 NFPA 251, or ASTM E119 and E814, including hose steam test at full-rated period.
- F. Pre-Molded Compressible Sealant (Pre-Finished):
1. Foam backing: Multiple layers of acrylic-impregnated, expanding foam sealant and closed-cell (EVA) foam.
 2. Weather facing: Low-modulus silicone with bellows profile.
 3. Movement capability: +/- 25% movement (50% total).
 4. Material to be sized appropriately for joint widths indicated.
 5. Color: Manufacturer's standard. Color to be selected by Architect.
 6. Installation adhesive: As recommended by manufacturer.
- G. Accessories:
1. Manufacturer's standard anchors, fasteners, set screws, spaces, flexible secondary water stops or seals and filler materials, drain tubes, adhesive and other accessories as indicated or required for complete installations.
 2. Compatible with materials in contact.
 3. Water stops.

2.2 FABRICATION

- A. General:
1. Use ceiling and wall expansion joint cover assemblies of same design as floor to wall and floor to floor expansion joint cover assemblies. Unless shown otherwise.

2. Provide expansion joint cover assemblies of design, basic profile, materials and operation indicated required to accommodate joint size variations in adjacent surfaces, and as required for anticipated structural movement.
3. Deliver to job site ready for use and fabricated in as large sections and assemblies as practical. Assemblies identical to submitted and reviewed shop drawings, samples and certificates.
4. Furnish units in longest practicable lengths to minimize number of end joints. Provide mitered corners where joint changes directions or abuts other materials.
5. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections and other assemblies.
6. Fire Performance Characteristics:
 - a. Provide expansion joint cover assemblies identical to those of assemblies whose fire resistance has been determined per ASTM E119 and E814, NFPA 251, or UL 263 including hose stream test at full-rated period.
 - b. Fire rating: Not less than rating of adjacent floor or wall construction.
7. Fire Barrier Systems:
 - a. Material to carry label of approved independent testing laboratory, and be subject to follow-up system for quality assurance.
 - b. Include thermal insulation where necessary, in accordance with above tests, with factory cut miters and transitions.
 - c. For joint widths up to and including 150 mm (six inches), supply barrier in lengths up to 15000 mm (50 feet) to eliminate field splicing.
 - d. For joint widths of seven inches and wider, supply barrier 3000 mm (10-foot) modules with overlapping ends for field splicing.
 - e. For joints within enclosed spaces such as chase walls, include 1 mm (0.032-inch) thick galvanized steel cover where conventional expansion joint cover is not used.
8. Seal Strip factory - formed and bonded to metal frames and anchor members.
9. Compression Seals: Prefabricate from thermoplastic rubber or dense neoprene to sizes and approximate profiles shown.

B. Floor-to-Floor Metal Plate Joints:

1. Frames on each side of joint designed to support cover plate of design shown.
 - a. Continuous frame designed to finish flush with adjacent floor of profile indicated with seating surface and raised floor rim to accommodate flooring.
 - b. Provide concealed bolt and steel anchors for embedment in concrete.
 - c. Designed for filler materials between raised rim of frame and edge of cover plate where shown.
 - d. Frame and cover plates of some metal where exposed.
 - 1) Design cover plates to support 180 Kg (400 lbs) per 0.3 square meters (1-square foot).
 - 2) Cover plates free of rattle due to traffic.
 - 3) No gaps or budges occur on filler material during design movement of joint.
 - 4) Provide manufacturer's continuous standard flexible vinyl water stop under floor joint cover assemblies.

C. Floor-to-Wall Metal Plate Joints:

1. Provide one frame on floor side of joint only. Provide wall side frame where required by manufacturer's design.
2. Angle Cover Plates: Provide angle cover plates for joints to wall with countersunk flat-head exposed fasteners for securing to wall unless shown otherwise.
3. Space fasteners as recommended by manufacturer.
4. Match cover of adjacent floor to floor cover.

D. Interior Wall Joint Cover Assemblies:

1. Surface Mounted Metal Cover Plates:
 - a. Concealed frame for fastening to wall on one sides of joint.
 - b. Extend cover to lap each side of joint and to permit free movement on one side.
 - c. Provide concealed attachment of cover t frame cover in close contact with adjacent finish wall surfaces.
 - d. Use angle cover plates at intersection of walls.
 - e. Use smooth surface cover plates matching floor plates.
 - f. Use expansion fire inserts in fire rated walls, rated same as hour rating of wall.

E. Exterior Wall Joint Assemblies:

1. Variable movement with seal designed to prevent water and air infiltration.
2. Use vinyl seal strip as secondary seal behind primary seal.
3. Cover Plate Assemblies:
 - a. Surface mounted cover plate.
 - b. Concealed frame for fastening to wall on one side of joint.
 - c. Extend cover to lap each side of joint and to permit free movement on one side.
 - d. Provide concealed attachment of cover to frame for cover with cover in close contact with adjacent finish surfaces.
 - e. Use angle cover plate of intersection of walls.
4. Extruded thermoplastic rubber joint assemblies.
 - a. Aluminum frames both sides of joint.
 - 1) Designed to receive flexible rubber primary seal on exposed face after installation of frame.
 - 2) Designed to receive continuous secondary vinyl sheet seal.
 - 3) Anchor spaced at ends and not over 600 mm (24-inches).
 - b. Variable movement extruded rubber primary seal designed to remain in aluminum frame, throughout movement of joint.
 - 1) Flush mounted seal minimum 3 mm (0.125-inch) thick with dual movement grooves designed for plus or minus 50 percent movement of joint width.
 - 2) Seismic seal minimum 3 mm (0.125-inch) thick with multi-movement grooves designed for plus or minus 100 percent movement of joint width.
 - 3) Recessed front face seal minimum 3 mm (0.125-inch) thick with no movement grooves, designed for plus or minus 50 percent movement of joint width.
 - c. Provide factory heat welded transitions where directional changes occur to ensure a watertight system.
 - d. Provide pantographic wind load supports, maximum 2400 mm (8 feet) on center to support seal systems of 300 mm (12-inches) and wider.
5. Pre-Molded Compressible Sealant:
 - a. Field applied sealant.

F. Ceiling and Soffit Assemblies:

1. Variable movement vinyl insert in metal frame on both sides of joint.
2. Designed for flush mounting with no exposed fasteners.
3. Vinyl insert locked into metal frame.
4. Vinyl and metal finish as specified in section 09 06 00, SCHEDULE FOR FINISHES.
5. Vinyl insert semi rigid either flush face or accordion shape as showed to span joint width without sagging.
6. Pre-Molded Compressible Sealant:
 - a. Field applied sealant.

G. Preformed Sealant Joint: Factory installed elastomeric sealant between extruded aluminum angle frame both sides.

1. Elastomeric Sealant: Two part polyurethane sealant with movement capability of +/- 25% of joint width per ASTM-C-920, Type M, Grade P, Class 25, Shore A hardness of 25+/-5.
 - a. Color:
2. Frame: Extruded Aluminum: Anodized.

2.3 METAL FINISHES**A. General:**

1. Apply finishes in factory after products are fabricated.
2. Protect finishes on exposed surfaces with protective covering before shipment.

B. Aluminum Finishes (Interior Joint Covers):

1. Finish letters and numbers for anodized aluminum are in accordance with the NAAMM AMP 501, Aluminum Association's Designation System).
 - a. Clear anodized finish: AA-C22A41 Chemically etched medium matte, clear anodic coating, Class I Architectural, 0.7 - mil thick.

C. Aluminum Finishes (Exterior Joint Covers):

1. Fluorocarbon finish: AAMA 605.2 high performance organic coating.
 - a. Color shall be selected from manufacturer's full color line by Architect.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Manufacturer's representative shall make a thorough examination of surfaces receiving work of this section.
- B. Before starting installation, notify prime contractor of defects which would affect satisfactory completion of work.

3.2 PREPARATION

- A. Verify measurements and dimensions at job site and cooperate in coordination and scheduling of work with work of related trades.
- B. Give particular attention to installation of items embedded in concrete and masonry so as not to delay job progress.
- C. Provide templates to related trade for location of support and anchorage items.

3.3 INSTALLATION

- A. Install in accordance with manufacturers installation instructions unless specified otherwise.
- B. Provide anchorage devices and fasteners for securing expansion joint assemblies to in-place construction including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide metal fasteners of type and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.
- C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.
- D. Install joint cover assemblies in true alignment and proper relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.
- E. Allow for thermal expansion and contraction of metal to avoid buckling.
- F. Set floor covers at elevations flush with adjacent finished floor materials unless shown otherwise.
- G. Material and method of grouting floor frames set in prepared recesses in accordance with manufacturer's instructions.
- H. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories.
- I. Locate anchors at interval recommended by manufacturer, but not less than 75 mm (3-inches) from each ends, and, not more than 600 mm (24-inches) on centers.
- J. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.
- K. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames or plates.

L. Flush Metal Cover Plates:

1. Secure flexible filler between frames so that it will compress and expand.
2. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

M. Waterstops:

1. Install in conjunction with floor joints and where shown, run continuously to prevent water damage to finish spaces.
2. Provide seal with frame to prevent water leakage.
3. Provide outlet tubes from waterstops to drain to prevent damage to finish spaces.

N. Fire Barriers:

1. Install in compliance with tested assembly.
2. Install in floors and in fire rated walls.
3. Use fire barrier sealant or caulk supplied with system.

O. Sealants:

Install to prevent water and air infiltration.

P. Vertical Exterior Extruded Thermoplastic Rubber.

1. Install side frames mounted on sealant or butyl caulk tape with appropriate anchors 600 mm (24 inches) on center complete with independent continuous PVC back seal.
2. Install primary seals retained in extruded aluminum side frames.

Q. Installation of Extruded Thermoplastic Rubber or Seals:

1. For straight sections, provide preformed seals in continuous lengths.
2. Vulcanize or heat-seal field splice joints to provide watertight joints using manufacturer's recommended procedures.

R. Installation of Preformed Elastomeric Sealant Joint:

1. Locate joint directly over joints in wall or floor substrates.
2. Full length shall be fastened to substrate using a construction adhesive.
3. Install flush or slightly below finish material.

S. Installation of Pre-Molded Compressible Sealant:

1. Fasten to substrate with integral mounting adhesive.
2. Conform to irregular openings.
3. Install flush or slightly below finish material.
4. Form final seal with field applied silicone sealant.

3.4 PROTECTION

- A. Take proper precautions to protect the expansion joint covers from damage after they are in place.
- B. Cover floor joints with plywood where wheel traffic occurs.

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